REPORT TO THE TWENTY-FIFTH LEGISLATURE
REGULAR SESSION OF 2010

DAIRY INDUSTRY STRATEGIC PLAN

In response to Act 46, SLH 2008

Prepared by:

THE STATE OF HAWAII
DEPARTMENT OF AGRICULTURE

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Section I

Background

A. Act 46, SLH 2008

In 2008, Governor Linda Lingle signed Act 46, which amended Chapter 157, Hawaii Revised Statutes (HRS), requiring that milk producers be paid the Class I price for milk when production of Hawaii-produced milk is less than one hundred per cent of the total production quotas for all milk sheds in the state. Act 46 also directed that "…the department of agriculture shall engage stakeholders of the Hawaii milk production industry to establish recommendations for short- and long-term initiatives to help ensure the availability of fresh milk for fluid consumption in Hawaii. Based upon the results of the engagements, the department of agriculture shall, together with the University of Hawaii (UH), College of Tropical Agriculture and Human Resources (CTAHR), prepare a written report and strategic plan recommending short and long term initiatives to help ensure the availability of fresh milk for fluid consumption in Hawaii." No funds were appropriated for the development of the strategic plan.

This combined report and strategic plan is the result of several meetings the department held with the state's two dairy farmers and with one individual who is planning to produce and distribute milk on Oahu. UH-CTAHR faculty made their research reports available to the Hawaii Department of Agriculture (HDOA) which were referenced in this report.

B. Hawaii Dairy Industry

The first commercial dairy was established in Hawaii in 1869, and by 1955, there were approximately 86 dairies throughout the islands. By 1982, Hawaii was totally self-sufficient in milk. Twenty-eight years later, there are only two dairies left in Hawaii.

The dynamics of the industry began to change dramatically as dairy operations on Oahu began to close in the 1970's as they came under land development pressure and were pushed out to marginal lands. In 1982, the contamination of local milk through the ingestion of heptachlor-treated pineapple tops by dairy cows contributed to a loss of public confidence in the safety of Hawaii produced milk and a decline in sales. At the time, no milk was allowed to be imported into the state.

In 1984, Safeway Stores brought suit against the State claiming violation of the Constitution's Commerce Clause, for denial of a distributor's license to import and sell mainland milk in Hawaii. The State argued that issuance of the license would tend to promote destructive or demoralizing competition in a market already adequately served or that it would not be in the public's interest. The court determined that States may not discriminate against interstate commerce even if the reason for the discrimination is to cancel out some advantage that out-of-state goods have over local products. The need to keep the local food industry viable was not taken into consideration. However, the court did not invalidate any section of the Milk Control Act. Safeway Hawaii, Inc began to import milk in 1985 and others followed in importing milk. There has been a steady decline in Hawaii's milk production since that time.

Current estimates suggest that over 90% of milk consumed in Hawaii is imported from the mainland. From the early 1980's to the late 1990's, Hawaii dairy industry annual sales decreased from $32.2 million to $14.5 million. In 2007, Hawaii dairy sales were $9.7 million.

The last commercial dairy farm on Oahu closed in February 2008. Both of the state's two remaining licensed dairy operations are located on the Big Island and production from these farms accounts for less than 10% of the total supply of fluid milk in Hawaii. Only a limited volume of milk produced on the Big Island is available for consumers on Oahu, Maui and Kauai. Obviously, the over-dependency on imported milk to meet local demand greatly increases Hawaii's vulnerability to supply disruption caused by unforeseeable local, national and global events.

C. Hawaii Department of Agriculture (HDOA) Programs Assisting the Dairy Industry

Milk Control Program

The Milk Control Program is administered within the Commodities branch of the Quality Assurance Division. Duties and responsibilities include:

- Inspect, investigate milk production, distribution and payments and perform market wide pool utilization calculations to determine fair payment to farmers.
- Issue milk licenses to producers, processors, and distributors; and monitor and adjust milk quotas.
- Conduct milk cost of production study as requested by industry.
- Adjust minimum prices paid to producers as needed.
- Oversee audits, promotions, and research projects as needed.
- Meet with individuals and industry groups to discuss, implement, coordinate and improve State's assistance to industry; ensure compliance with laws and rules; resolve industry problems; encourage collective action; and improve production and marketing.

Livestock Feed Reimbursement Program

The Livestock Feed Reimbursement Program (LFRP) is administered within the Market Development branch of the Agricultural Development Division.

The LFRP was developed to implement Act 221; a bill proposed by HDOA and passed by the 2007 Hawaii Legislature. The purpose of Act 221 (2007) is to create a livestock revitalization and food security program to administer and disburse funds to qualified dairy, cattle, hog, and poultry farms that apply for and receive, with proper documentation, a reimbursement for up to 60 percent of each farm's feed expenses. With financial support, the livestock industry will be able to make capital investments, expand and improve their herds and flocks, and develop new markets and products. This financial support will serve a public purpose by enabling the livestock industries to stabilize their operations; thus, contributing to food security, and helping them become more competitive with mainland suppliers in the future.

Reimbursements shall not exceed a total of $250,000 per qualified producer per year and shall be filed for feed purchased within the immediately preceding State fiscal quarter of filing and shall be effective for feed costs incurred after July 1, 2007.

A Qualified Producer is any person that, at the time of application, is in the business of producing the following:

1. Milk from a herd of not less that 350 cows;
2. Poultry from a flock of not less than 3,000 birds;
3. Pork from a herd of not less than 50 sows;
4. Beef producers who finish in Hawaii at least 100 head annually.

A total of $3 million was appropriated in State FY 2008 (July 1, 2007 – June 30, 2008) and the same amount in State FY 2009 (July 1, 2008 – June 30, 2009) with the program sunsetting on December 31, 2010. Due to the state's dire financial situation, funding was not released after mid-2009. From the inception of the program, $3.8 million was approved for feed reimbursements, $1 million of which went to dairy producers.

Buy Local, It Matters

Buy Local, It Matters is administered within the Market Development branch of the Agricultural Development Division. Starting out years before with the slogan Buy Fresh Buy Local, the successful program evolved into Buy Local, It Matters, a promotional campaign that aims to encourage Hawaii residents to support Hawaii farmers by making conscious decisions to purchase locally grown produce and other agricultural products (including milk). It is a joint effort involving the HDOA, UH-CTAHR, the Hawaii Farm Bureau Federation, the Economic Development Association of Hawaii, the County of Hawaii and others.

Livestock Disease Control

The Livestock Disease Control program is administered within the Livestock Disease Control branch of the Animal Industry Division.

The mission of the branch is to prevent, detect, diagnose, control and eradicate livestock diseases in order to promote the health and economic well-being of the livestock industries in Hawaii. Surveillance for regulatory diseases is conducted routinely to identify diseases which constitute a threat to the State's livestock industries and public health. The Branch consists of veterinary medical officers, livestock inspectors, animal caretakers, management and support staff.

Section II

Critical Issues

Discussions with the two dairy farmers and one prospective dairy farmer and a review of the research literature identified five critical issues that need to be addressed to sustain and encourage growth in Hawaii's dairy industry.

Issue 1: Market Demand for Hawaii Produced Milk

Goal 1: Determine the market demand for Hawaii produced milk by island, market segment, and price points.

A study conducted in 2007 by C.N. Lee of UH-CTAHR stated that approximately 360,000 gallons of milk is imported weekly from the mainland. The majority of demand according to Dr. Lee's study is for low fat and skim milk (76-79%) while whole milk comprised 21-24% of demand. The largest consumer groups are children and the elderly.[1] Children 14 years and younger are expected to total 254,840 in 2010 and increase to 281,150 by 2020. In 2010, those people 65 or older are expected to total 190,340 and increase to 261,210 by 2020[2].

A consumer survey was designed and completed in the fourth quarter of FY 2009. The HDOA's Commodities branch had planned to conduct the survey in stores in early 2010; however, retailers wouldn't consent to it. A different approach will have to be developed to determine the current statewide market demand for milk. A copy of the survey is included as Appendix A.

Issue 2: Adequate Resources for Dairy Production

Goal 1: Determine land needs for dairy production.

Research has shown that allowing cows to roam on pastures is very important for the overall quality of the milk they produce. Grazing also significantly reduces feed cost.

Provisions must also be made to ensure the proper disposal of animal waste. A minimum of 1,000 acres is needed to meet the assimilation capacity of pasture land for the spreading of manure from 500 cows[3] in a confined animal feeding operation. However, more land would be needed for a dairy grazing operation.

To provide some perspective, 22,000 acres of pasture land would be needed to provide adequate grazing and waste assimilation capacity for 8,800 animals (4,400 milking cows plus 4400 replacement animals) to supply 50% of Hawaii's milk

[1] C.N. Lee, *Issues Related to Hawaii's Dairy Industry*, Department of Human Nutrition, Food, and Animal Science, College of Tropical Agriculture and Human Resources, University of Hawaii, Manoa, p. 19
[2] Department of Business, Economic Development and Tourism, *Population and Economic Projections for the State of Hawaii to 2035*, http//Hawaii.gov/DBEDT/info/economic/data_reports/2035LongRangeSeries/Index_html
[3] Comprehensive Nutrient Management Plan National Template

demand which is estimated to be 27,400 gallons per day. Additional acreage will be needed if the dairy operation chooses to grow supplemental feed crops such as corn.

Critical Land Issues:

- Lands with the following characteristics:
  - Cooler climate (Higher elevation)
  - Good drainage/low water runoff (not in proximity to nearby waterways).
  - Level land for cultivation of feed crops (3-5 % slope maximum).
  - Water source-both potable for milk barn and cows, and non-potable for irrigation of pasture and feed crops.
- Provisions for long-term lease agreements.
- Access to affordable loan programs to finance land improvements or purchase.
- Progress on Important Agricultural Lands (IAL) designation by the private sector and Counties and lands transfer (both public IAL and non-IAL) from Department of Land and Natural Resources (DLNR) to HDOA to help assure lands stay in agriculture.
- Access to incentives for Important Agricultural Land designation (both private and State lands).

Identification of public IAL lands is in progress and non agricultural park land transfers from DLNR to HDOA began in 2006 and are on-going. In June 2009, the State Land Use Commission approved a petition to designate over 27,000 acres of private land on Maui as IAL and approval was granted to designate 3700 acres of private land on Kauai as IAL in an earlier petition. In addition, Kauai County has started its process to identify and map lands they will recommend to be designated as IAL.

Goal 2: Ensure an adequate supply of potable and non-potable water for milk production.

A reliable water source is important to ensure that cows have enough water to drink and that forage crops can be irrigated when needed. Many agricultural areas throughout the State have been hard hit by drought in recent years and the lack of water has created severe problems for pastureland.

Using the example to supply 50% of Hawaii's milk demand, it is estimated that 440,000 gallons of potable water per day[4] is needed to sustain a dairy herd of 4,400 milking cows and 4,400 replacement animals. Depending upon the source of the water, cost per thousand gallons can range from .475/1,000 gallons from a state irrigation system to $6.00/1,000 gallons from a private water provider. An additional amount of non-potable irrigation water will be needed as dictated by pasture conditions, type of feed crops grown, and environmental conditions.

[4] Bahman Sadeghi, Island Dairy owner, County of Hawaii

Critical Water Needs:

- Dairies need access to lands with affordable sources of water for herd, feed crop and pasture requirements. Areas with enough rainfall to support healthy pastures are preferable to minimize the need for pasture irrigation, which may not be economically feasible on a regular basis.
- Continued legislative support to provide capital improvement project funds for irrigation systems and reservoirs.
- Dairies will pursue opportunities to reduce water pumping costs through investment in alternative energy technologies.
- Ensure that livestock as well as crop needs are considered in the off-stream uses when the Commission on Water Resource Management sets in-stream flow standards**.**

Issue 3: Effective Regulations

Goal 1: Conduct a thorough review of the Milk Control Act and the administrative rules. Update the Act and the rules as needed to reflect current trends in the industry.

The dairy industry is a vital part of the agricultural industry that is protected in the publics' interest. All states have specific laws to ensure the reliable supply of fresh and wholesome milk, as milk is considered to be an essential component in the daily diets of children and the elderly. To ensure a steady supply of fluid milk in Hawaii, production quotas are established and pricing is regulated to assure producers a stable income and return on investment. In 1967, the Milk Control Act (Chapter 157 HRS) was passed by the Legislature to ensure the availability of fresh milk for consumption in Hawaii and to preserve and protect the industry. Hawaii Administrative Rules (HAR) and regulations were adopted in 1970 (Title 4-60 HAR) to enforce provisions of the Milk Control Act. Title 4-60 enforces licensing, license fee rules, minimum milk price rules, and milk production quota rules, in addition to general provisions.

There have been limited changes to the laws and rules governing the Milk Control Act since its inception over forty years ago. This is in spite of economic, market, and technological changes.

Critical Aspects of the Milk Control Act and the Administrative Rules:

<u>Quota</u>
The system of quota as modified in the early 1990s allows the State to hold the quota for those producers who are not producing 90% of quota. All quota forfeited is placed in reserve within the State. The State has the authority to award quota back to the producer when production increased. All available quota can currently meet 50% of consumer needs.

<u>Pricing</u>
A responsive pricing formula is needed to adjust, in a timely manner, the price of milk paid to producers. The formula will account for fluctuations in production and market parameters that affect the value of milk. The pricing of milk will represent the fairest

return on investment for a given volume of Class I milk. A draft of the pricing formula (see Appendix C) has been developed by HDOA, Agricultural Development Division. The formula incorporates key parameters such as the Northern California price for milk, a feed cost index, and the Moody's Corporate Bond Index to establish cost of production and profit margins.

Milk Sheds

Presently, there are two milk sheds in the State, Oahu and Big Island. The Big Island milk shed is the only functional shed which serves two licensed dairy operations. All dairies on Oahu have been closed. Kauai and Maui opted not to be governed by the Milk Control Act, therefore no milk sheds exist for those counties. Regulations must be updated to include the entire State so as to increase opportunities for existing dairies and to attract future operations to the State. Changes in the Milk Control Act and its administrative rules will ensure that producers have order and fairness in a dynamic market place.

A summary of proposed changes to Chapter 157 HRS with regard to quota, pricing, and milk sheds can be found in appendix B. Further discussion with the industry will take place this year to gain agreement on the proposed changes and pricing formula.

Issue 4: Encourage and promote research that improves production and profitability.

Goal 1: Investigate the potential for expanding traditional and alternative feed sources.

Feed for cows is the highest cost item for dairy farmers. Currently, most feed is imported to supplement the nutritional needs of lactating cows. With escalating fuel and transportation costs, this becomes a very heavy burden on dairy farmers. Locally grown feed for dairies would significantly lower the cost of production.

A study is now underway at the University of Hawaii at Hilo to identify tropical forages and their use as a feed source and the selection of dairy cows suitable for small farms. The results of this study are expected in the next few years. Forage trials are also in process for both dairies.

Critical Feed Issues:

- Identify current producers, quantities, types, locations, and costs of traditional, locally grown feed.
- Identify alternatives to traditional feed sources, such as discarded crop residues and byproducts.
- Explore potential byproducts from the emerging renewable energy producers.

APPENDIX A

Consumer Survey Questionnaire

Store: _____ **Date:** _____

1. **Gender:** ____M ____F
2. **What is your age bracket?** ____<20 ____20-30 ____31-40 ____41-50 ____>50
3. **How many people in your household?** ____ **How many drinks milk everyday?** ____
4. **Brand, size, and type of milk being purchased today.**

   Brand: _____

   Indicate number of containers purchased: ____gallon ____½ gallon ___quart

   Type: ____fat free (skim) ____low fat (1%) ____reduced fat (2%) ____whole

   Do you normally purchase this brand? ____yes ____no

   Why did you purchase this particular brand today? (1 answer)

   ____name ____price ____date ____taste ____local product

5. **How much milk do you normally purchase every week? (1 answer)**

   ____less than 1 gallon ____1 gallon ____2 gallons ____more than 2 gallons

6. **Can you identify the "*Island Fresh*" logo on store products?** ____yes ____no
7. **Did you purchase milk with an "*Island Fresh*" logo on the package in the past month?**

   ____yes ____no ____not sure

   If <u>yes</u>, what brand? _____ **what store?** _____

8. **Do you drink milk?**

   If <u>yes</u>, why (1 answer) ____health benefits ____taste good

   If <u>no</u>, why (1 answer) ____lactose intolerant ____bad for health ____don't like taste

9. **Did you ever have milk go bad <u>before</u> the date on the container?** ____yes ____no

Consumer Survey Protocol

1. Request permission from the store manager to conduct the survey. Inform the manager that copies of completed survey forms from their store will be made available upon request.

2. If approval is granted by the store manager, identify the store and record the current date at the top of each form that is utilized to conduct the survey.

3. At the stores' dairy case, approach individuals who are purchasing gallon, half-gallon, or quart size, non-flavored milk and ask if they would like to participate in the survey.

4. If they are willing to participate, ask individuals for whom they are purchasing the milk. Only survey individuals that are purchasing milk for their own or their family's consumption. Do not survey those who are buying milk for someone else.

5. You will be the one who enters participant responses on the survey form. Participants may be shown the survey form as the survey is being conducted.
    a. Note: If a participant asks a question about a survey item, do not answer the question if you feel that your answer will bias their response to a survey item. Inform participants that all questions will be addressed after their survey is completed.

Rational for Inclusion of Survey Items

Items 1, 2, and 3: provides demographic information of survey participant and household members.

Item 4: provides information on the preference and reason for preference of purchased milk.

Item 5: provides information on weekly consumption of milk.

Items 6 and 7: provides information on the level of recognition and awareness of the "Island Fresh" label and of locally produced milk.

Item 8: provides information on the proportion of participants that consume milk and as to why they drink or not drink milk.

Item 9: provides indirect information and insight on the possibility of food safety issue through consumer experience.

APPENDIX B

Summary of Proposed Changes to Chapter 157, HRS and Title 4-60, HAR

Quota:

Quota will represent the demand for milk within a geographical area such as the State (total quota) or a county (county quota). With the elimination of milk sheds, quotas will be established within the State by counties. Currently, quota only exists in the counties of Honolulu and Hawaii.

It is envisioned that Honolulu County and Hawaii County will retain their present quota limits. Kauai County and Maui County will each have quota limits based on consumer demand for milk in each county. A producer will be able to request and acquire quota in the same manner that is currently prescribed. The total amount of quota that producers can accumulate will depend on their ability to produce and deliver milk.

Pricing:

A pricing formula will be employed to calculate monthly minimum price for milk within each county where the milk is utilized. See Appendix C for details.

Milk Sheds:

The term “Milk shed” will be deleted from Chapter 157 HRS. All references to “milk shed” will be deleted from Chapter 157 and sections of this chapter will be amended to reflect this deletion. This deletion would permit the Hawaii Board of Agriculture to control milk in the entire State, rather than just within the County of Honolulu (Honolulu milk shed) and the County of Hawaii (Hawaii milk shed).

APPENDIX C

Proposed Milk Pricing Formula:

Hawaii Milk Shed

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FINAL
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Disclaimer

The views and opinions expressed herein, where found, are those of the author and do not necessarily represent or reflect the position of the Hawaii Department of Agriculture.

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I. Introduction

Hawaii's dairy industry has been in a state of decline to near-extinction in recent years. Developing a pricing policy that encourages production may be a sensible solution to this situation. Hawaii imports approximately 80-85 percent of its fluid milk and approximately 80 percent of that is imported from California, one of the most productive milk producing regions in the United Sates. The cost of producing milk in California is approximately half the cost of Hawaii-produced milk. This is due to nearly twice the output per cow combined with relatively lower input costs.[1] Thus, in pricing Hawaii-produced milk, northern California Class I milk price plus shipping cost must be taken into consideration.

Based on the history of Hawaii's dairy industry, price stability and cost of production-based pricing that requires cumbersome administrative procedures do not assure the industry's financial viability. While the minimum price for milk produced in the Hawaii milk shed has increased to account for higher cost of production, the administrative process of price increase takes many months before a new, higher minimum price becomes effective.

It is critical that the milk price paid to producers be responsive in a timely manner to changes in the cost of production. The pricing formula must allow for adjustments to limit losses by producers when input cost experience sustained or drastic increases, and to benefit consumers when input prices fall. Also, milk price must be responsive to changes in the market competitive condition to encourage productivity. In order to allow price to adjust with changes in market conditions on a timely basis, the Milk Control Program should be entrusted with full authority to adjust milk price on a monthly basis.

This report gives a detailed account of the development of a pricing formula for dairy producers under the Hawaii milk shed on the Big Island.

[1] In 2007, the average milk output per cow per year in California was 22,440 pounds compared to 12,241 pounds in Hawaii.

II. Brief Historical Background of Milk Pricing in Hawaii

The state of Hawaii has two milk sheds, the Honolulu milk shed (Honolulu County) and the Hawaii milk shed (Hawaii County). Both milk sheds had a pricing system based on cost of production since the enactment of the Milk Act in 1967. In 1998, the Honolulu milk shed departed to a pricing system based on the northern California price plus shipping cost and a premium. The last commercial dairy farm under the Honolulu milk shed ceased to operate in March 2008. The Hawaii milk shed, which is the focus of this study, continued using a fixed price system based on the cost of production.

Hawaii had two price classes, I and II, of fluid milk until April 2008, when Act 046 (S.B. 2956) was approved, and stipulated that processors must purchase milk produced in Hawaii at the Class I price "up to one hundred per cent of the total production quotas for all milk sheds in the state".[2] In Hawaii, the price gap between the two classes was considerable. Between January 2006 and December 2007, the Hawaii milk shed average Class I price ($27.28/Cwt) was nearly doubled that of Class II ($14.18/Cwt). However, the majority of milk produced in Hawaii was sold as Class I. All milk prices are stated in terms of dollars per hundredweight ($/Cwt), unless specified.

The minimum price for Class I milk that the processor must pay producers in the Hawaii milk shed under the existing system has been fixed and therefore irresponsive to changes in market condition. Any changes to the price must be approved through the time consuming administrative and legislative processes. The latest minimum price change for milk produced in the Hawaii milk shed for Class I milk took place in November 2008.[3] The price increased from $29.53/Cwt to $35.53/Cwt. Prior to that, the Hawaii milk shed's minimum price increased from $23.53/Cwt to $26.53/Cwt in January 2005 and, again, to $29.53/Cwt in July 2007.

The entire process for the latest price increase to take effect, from the submission of a formal request by producers to the Hawaii Department of Agriculture to the date the new price took effect, was nine months.[4] The process of price adjustment in the past also took months before a proposed price was approved and placed into practice. While the existing Hawaii milk shed pricing system provided price stability, it did not allow for a timely price adjustment to reflect changing cost conditions. This was especially evident during times of economy-wide market instability associated with rapid rises in input costs, during the 2007 and 2008. As a result, producers were forced to operate under a lost for an extended period of time.

As mentioned above, milk producers in the Hawaii milk shed are guaranteed a minimum price of $35.53/Cwt for Class I fluid milk. The processor must pay this price to producers.[5] This price

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[2] The two classes are based on utilization. Class I is for fluid milk consumption and Class II, for use in "soft manufacturing" that includes ice cream, yogurt, ice milk, cottage cheese, sour cream, etc.

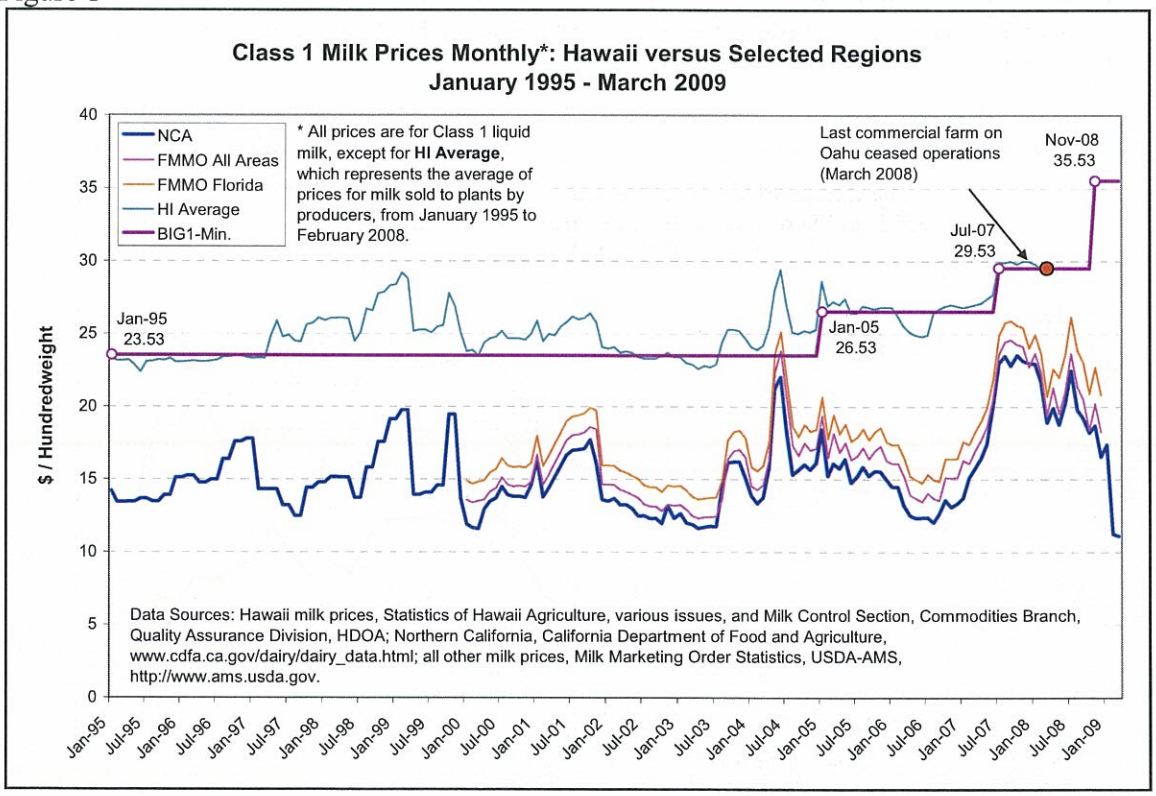
[3] Class 1 milk price is based on milk with 3.3% of butterfat content - Hawaii Administrative Rules §4-60-10.

[4] Upon receiving a formal request for price increase by producers in February 2008, the Milk Control Program of HDOA initiated a 14-step rule change procedure according to the Administrative Directive No. 99-02. Final approval of the price change was granted in October 2008, and the new price became effective on November 1, 2008.

[5] Although the minimum price is based on fluid milk with 3.3% of fat content, the actual price producers receive could be slightly lower or higher, depending on whether fat content is less than or more than 3.3%.

was more than double the price of northern California Class I milk in December 2008 ($16.57/Cwt) and nearly double the average price for all areas under the Federal Milk Marketing Order ($18.30/Cwt).[6] Hawaii's prices are compared with average Class I milk prices for northern California (NCA), other selected regions under the Federal Milk Market Order (FMMO All Areas), and of the state of Florida (FMMO Florida) in Figure 1. "HI Average" represents the weighted-average price of all milk produced in the state of Hawaii and "BIG1-Min." represents the minimum Class I milk price for the Hawaii milk shed. Prices for milk produced in Hawaii were consistently higher than all other regions, except for the months of May and June 2004, when FMMO Florida price exceeded that of the Hawaii milk shed. The FMMO All Areas milk price also exceeded that of the Hawaii milk shed in June of that same year. The HI Average also spiked in those months, as a result of the surge in price in the Honolulu milk shed.

Figure 1

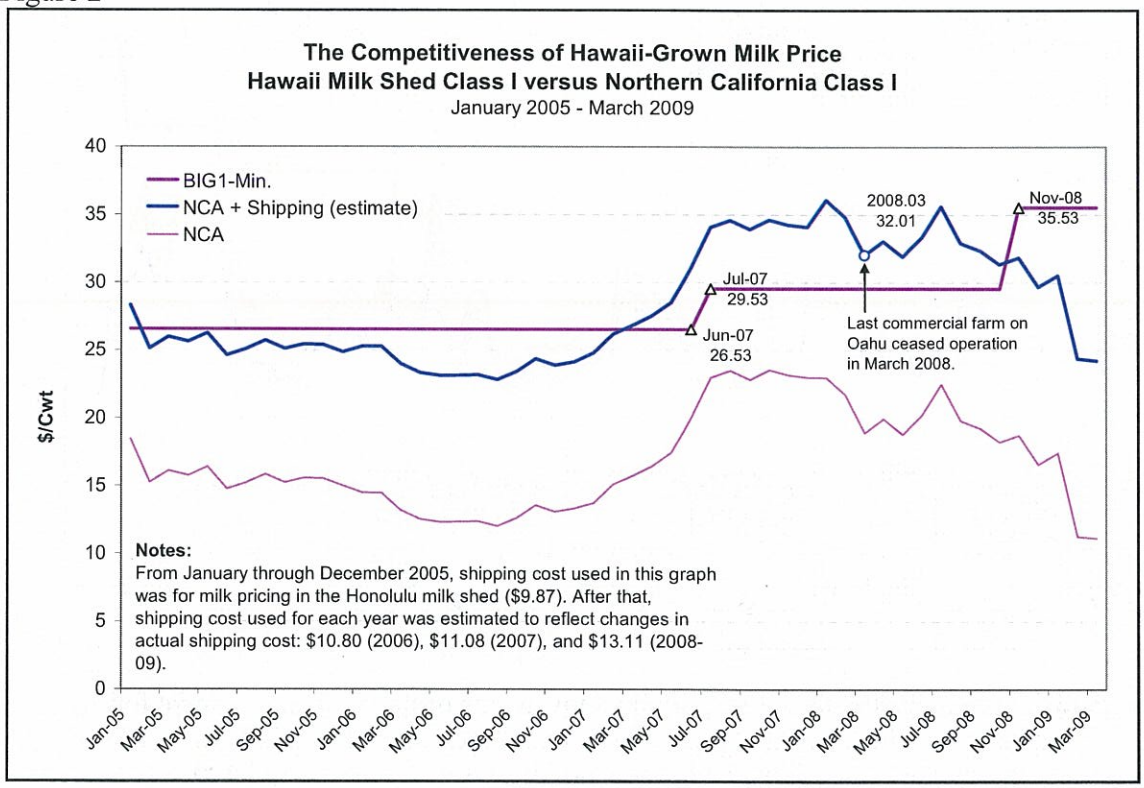


Also noteworthy in Figure 1 is the corresponding movements of the price lines except for the price of the Hawaii milk shed, which is held constant with incremental step increases. The HI Average price line shadows the NCA and FMMO prices, especially after April 1997. The price of milk produced in the Honolulu milk shed, where most of the milk was produced until 2007, was based on that of northern California milk prices, which in turn is closely related to FMMO prices.

[6] The Federal Milk Marketing Order (FMMO) is "a system designed to facilitate the marketing of milk in the United States, by specifying conditions under which milk handlers must operate within certain geographic areas."

Because Hawaii-produced milk competes directly with milk produced in the northern California region, it is reasonable to compare Hawaii milk prices with that of northern California.[7] Figure 2 shows three graphs: two represent the northern California Class I milk price with shipping cost added (blue line) and without shipping cost added (pink line), and the third graph shows the Hawaii milk shed Class I milk price. This figure demonstrates that, with shipping cost added to the base price for Class I northern California milk, the price gap between milk produced in the Hawaii milk shed and that of the inter-state import narrows considerably. It even rose above that of the Hawaii milk shed price between March 2007 and October 2008. This was a combined result of the northern California milk price and shipping cost movements. However, during this period, while northern California Class I price and milk shipping cost were rising, feed prices and the cost of shipping feed to Hawaii were also rising thus increasing local producers' cost of production. This in turn eroded Hawaii producers' price advantage gained from northern California milk price and shipping cost increases. With the collapse of northern California milk price, by March 2009, the Hawaii milk shed Class I price exceeded that of northern California (plus shipping cost) by $11.29/Cwt.

Figure 2

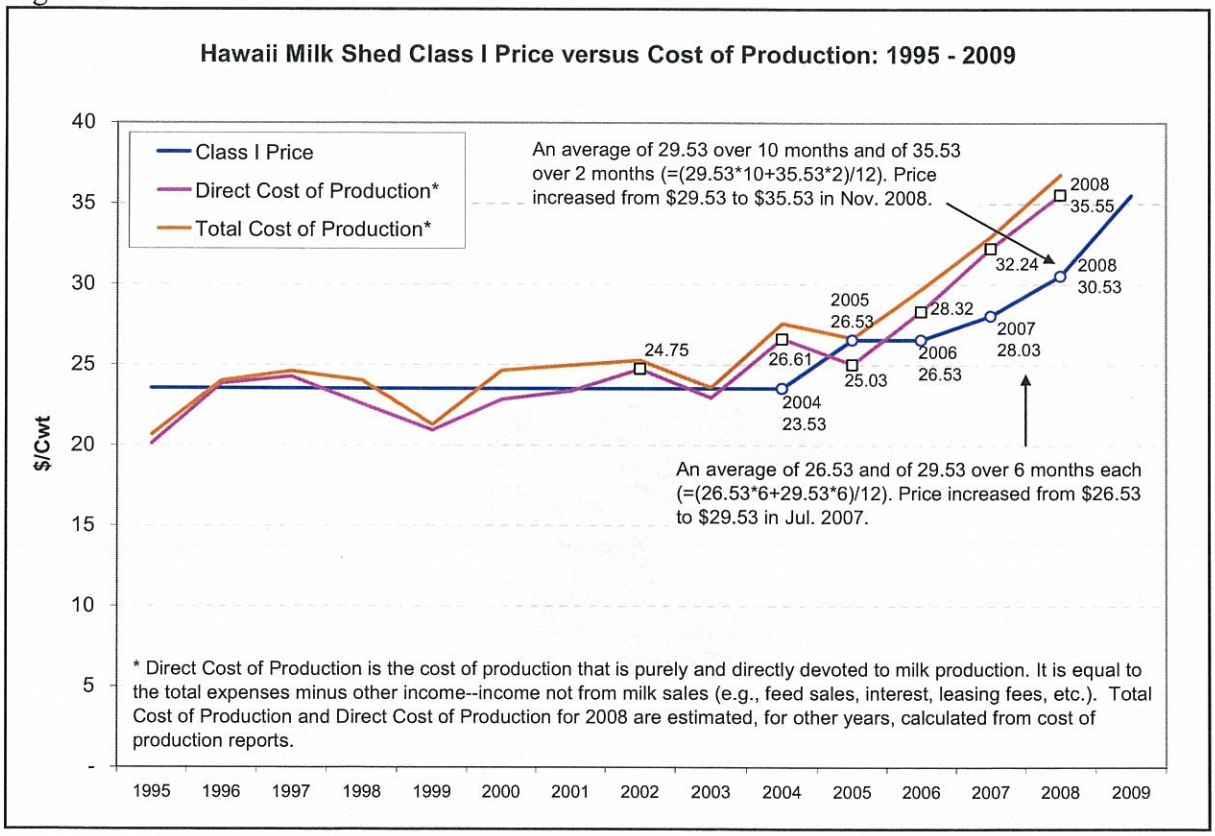


The Hawaii milk shed minimum price has displayed a degree of stability over an extended period of time, with occasional increases (Figure 2). Despite this stability in price, the most important question to the producer is whether the price received for milk is above or below the cost of production. The available cost of production data from 1995-2007 revealed that Big Island milk producers were receiving payments for their milk below the direct cost of production in 1996-

[7] About 80 percent of fluid milk imported into Hawaii originates from California.

1997, 2002, 2004, and 2006-2007. In 2008, the cost of production was estimated by evaluating the historical behavior of the cost of production and new input prices within that year. The estimated result indicates that producers were operating under a loss in 2008. This is illustrated in Figure 3, which compares annual average prices and cost of production. The data shows that from 1995 through 2008, producers were operating at a loss for seven of the 14 years. The direct cost is the total operations cost less other income from sources that are not directly linked to milk sales (may include income from feed sales, leasing of land or equipment, sales of cows, heifers or calves, interest income, etc.).[8]

Figure 3

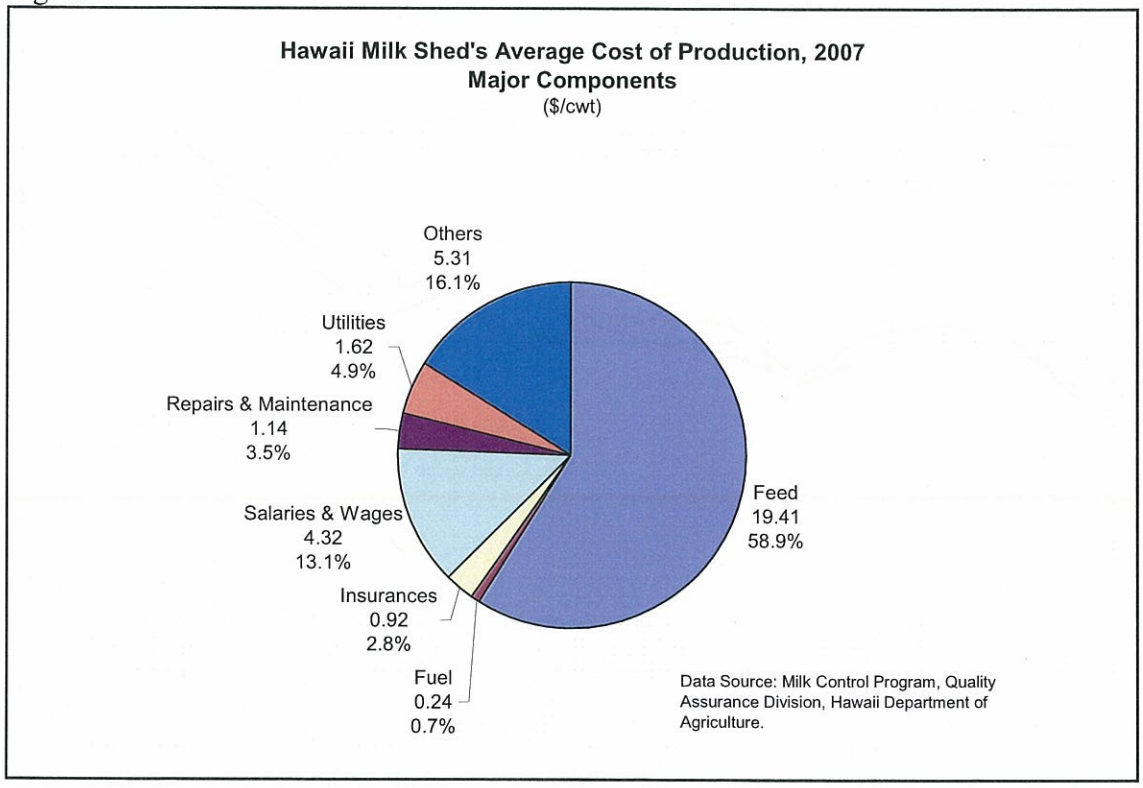


[8] Other income from 1995-2007 ranged between 0.7 percent and 7.3 percent of total cost of operations, with an average of 3.4 percent.

III. Cost of Production in the Hawaii Milk Shed

Feed cost has always been the major concern for all milk producers in Hawaii, because it accounts for the largest share of all cost categories. It averaged 59 percent of the total cost of production in 2007. The second largest cost category was for wages and salaries, which accounted for 13 percent of the share. Figure 4 shows the average cost required to produce 100 lbs (11.63 gallons) of milk in 2007, in terms of dollar value and proportion of major cost categories. The cost category labeled "Others" includes items such as freight and hauling, shipping, interest on loan, rent, fees, taxes, veterinarian, etc.

Figure 4



Feed cost is subject to a number of factors that are beyond the control of dairy farm producers. They include the weather which could influence global supply of and demand for dairy feed, the cost associated with transporting feed, and nontraditional uses of feed ingredients, such as corn for ethanol conversion.

In a national comparison of the cost of producing milk in 2007, Hawaii was among the most costly, although not the most costly state. Table 1 compares cost of production in the Hawaii milk shed and in selected states. The two most costly states were Maine and Tennessee, and the two largest and among the least costly states were California and Wisconsin. In that year, the total cost of production in the Hawaii milk shed was $32.96/Cwt. That was more than double California's ($16/Cwt). Hawaii's relatively high per unit cost of production was mainly

attributable to feed cost.[9] The Hawaii milk shed's cost structure was very similar to California's in that both the Hawaii milk shed and California had a high share of feed cost; 58.9 percent for the Hawaii milk shed and 59.8 percent for California. California producers allocated 11.6 percent of total cost of production to labor (direct and indirect) while the Hawaii milk shed allocated 13.1 percent. This was followed by Tennessee (221 percent), Wisconsin (23.6 percent), and Maine (27.4 percent). Among the selected regions in Table 1, the Hawaii milk shed had the lowest depreciation cost allocation (3.2 percent), while Tennessee had the highest (20.4 percent), followed by Maine (16.5 percent), Wisconsin (15.5 percent), and California (11.6 percent).

Table 1. Cost of Production in 2007[1]: Hawaii Milk Shed versus Selected Regions

	Hawaii Shed	California	Maine	Tennessee	Wisconsin
Total feed cost ($/Cwt)	19.41	9.56	13.27	14.61	7.83
% Share	*58.9*	*59.8*	*39.2*	*41.4*	*38.8*
Total labor cost ($/Cwt)	4.32	1.85	9.28	7.81	4.75
% Share	*13.1*	*11.6*	*27.4*	*22.1*	*23.6*
Depreciation ($/Cwt)	1.04	1.85	5.57	7.19	3.12
% Share	*3.2*	*11.6*	*16.5*	*20.4*	*15.5*
Land rent ($/Cwt)	0.53	-	0.06	0.09	0.03
% Share	*1.6*	*0.0*	*0.2*	*0.3*	*0.1*
Others ($/Cwt)	7.66	2.74	5.67	5.61	4.43
% Share	*23.2*	*17.1*	*16.8*	*15.9*	*22.0*
Total Cost of Production ($/Cwt)	**32.96**	**16.00**	**33.86**	**35.31**	**20.16**

[1] Dollar amount listed is the simple average of the monthly cost data to produce 100 pounds of milk.

The rapid rise in the cost of production in recent years was mainly due to frequent and rapid increases in feed cost. Table 2 illustrates the significance of feed cost in milk production, and the extent to which recent increases in feed cost have affected the overall cost of production in the Hawaii milk shed over 2003 - 2008. As shown in Table 2, although other cost items increased, feed cost was the major factor contributing to the rise in the cost of production over this period. Between 2003 and 2008, feed cost was more than doubled, rising from $10.81 to $22.72, while other costs nearly remained constant over this entire five-year period. Feed cost share of the total cost of production rose from 46 percent in 2003 to 59 percent by 2007, and to 64 percent in 2008, as a result of the multiple and rapid increases in feed commodity prices and shipping costs. Cost of production for 2008 was estimated using the proposed pricing model as described below. Other years were calculated from cost of production reports provided by the Milk Control Program, HDOA.

[9] Hawaii's relatively high per unit cost is also attributable to the relatively low milk production per cow.

Table 2. Role of Feed Cost in Recent Increases in Milk Production Cost Hawaii Milk Shed

(Weighted average cost, expressed in dollars per hundredweight, unless specified)

		2003	2004	2005	2006	2007	2008*
1	Feed Cost ($/Cwt)	10.81	14.24	15.31	16.54	19.41	22.72
	Percent change		*31.9*	*7.4*	*8.1*	*17.3*	*17.0*
2	Other Costs ($/Cwt)	12.78	13.31	11.36	13.14	13.55	12.83
	Percent change		*4.1*	*-14.6*	*15.7*	*3.1*	*-5.3*
3	Total Cost ($/Cwt)	23.60	27.56	26.67	29.69	32.96	35.55
	Percent change		*16.8*	*-3.2*	*11.3*	*11.0*	*7.9*
4	*Feed Cost % Share in Total Cost*	*45.8*	*51.7*	*57.4*	*55.7*	*58.9*	*63.9*
5	*Feed Cost % Contribution to Total Cost Change*		*86.8*	*117.8*	*40.9*	*87.7*	*127.6*

* Costs for 2008 are estimated from the pricing model developed.

IV. The Formula

IV.I. Major Variables

Base year cost of production is used as a benchmark for deriving a new price for milk paid to producers. All costs and prices are expressed in terms of dollars per hundred pounds of milk ($/Cwt), unless otherwise specified.[10] In the formula, base year cost of production is updated annually for all cost variables. Major variables that influence changes in the cost of production are monthly variations in feed cost and the Rate of Investment Allowance (RIA).

Feed cost is the major mover of milk price and may account for more than 50 percent of the total cost of production. It can rise to above 65 percent of total production cost during times of feed market turbulence. In an average year, producers within the Hawaii milk shed purchase 55-65 percent of their feed from the mainland. Feed cost is very dynamic; it changes weekly. Data for feed prices in the California market that are used for developing and updating a feed cost index in our formula are conveniently available online. Weekly updates are made available by USDA-AMS at www.ams.usda.gov. Other cost components are comparatively insignificant and relatively stable over the course of a year.

The RIA, which follows the Moody's Seasoned Baa Corporate Bond Index, is included in the formula to account for opportunity cost of investing in the dairy operation.[11] That is, the opportunity cost of investing in milk production is equivalent to the rate of return of alternative investments in bonds represented by the Moody's Seasoned Baa Corporate Bond Index. It can be referred to as a "*normal profit*" rate. The index is updated monthly and can be downloaded from the Federal Reserve Bank of St. Louis' website:
http://research.stlouisfed.org/fred2/categories/119.

Other cost variables are kept constant as they are relatively stable throughout the year, but can be updated annually with a new report on actual cost of production. These other cost variables include items such as costs for labor, leases, veterinarian and laboratory fees, insurances, etc. Fuel price increases are usually translated into a general inflation across sectors, with some lag time. This is captured in the model through an annual calibration of the base year cost of production and subject to the availability of actual cost of production data. Although fuel price is relatively unstable, especially in recent years, direct fuel cost is kept constant in the model and to be updated annually. The influence of fuel price volatility will be entered into cost of milk production indirectly in the form of monthly adjustments in feed cost, which is subject to shipping cost and fuel price fluctuations. For example, in February 2008, when the month-average crude oil price was $87.41 per barrel, alfalfa hay (supreme) was sold in California for $12.75 per 100 lbs and the cost for shipping it to the Hawaii milk shed was $9.64. When the month-average crude oil price increased to $127.77 per barrel in July 2008, the price for alfalfa

[10] A hundredweight (100 lbs) of fluid milk is equivalent to 11.6279 gallons.
[11] Moody's monthly Corporate Bond Index is the average of daily data for bonds with the remaining life of at least 20 years. The index is developed for bonds with the remaining maturity as close as possible to 30 years.

hay (supreme) sold in California and shipping cost also increased to $13.56 and $10.06, respectively.

IV.II. Unconditional Pricing Formula versus Conditional Pricing Formula

The pricing formula in its basic form is called the **Unconditional Pricing Formula**. This formula generates the price of the Hawaii milk shed Class I milk that is purely based on partial changes in the cost of production and the RIA. Price fluctuation is unrestricted.

The **Conditional Pricing Formula** is based on conditions such as responses to changes in the northern California Class I milk price and a **prize stabilizer** that limits the range of price fluctuation to suit the desired pricing policy. This formula calculates the new Class I milk price in the Hawaii milk shed that is subject to the two conditions mentioned above. The **first condition** is based on fluctuations in the northern California Class I price plus shipping cost from northern California to Honolulu, Hawaii. The **second condition** is governed by a **price stabilizer** which sets a pre-determined range for price fluctuation. Milk produced in Hawaii is competing with milk imported mainly from northern California. Thus, conditioning the new price of Hawaii-produced milk to that of northern California, plus shipping cost, allows the price of Hawaii-produced milk to be responsive to competitive market conditions. For instance, a fall (or rise) in the northern California Class I milk price would produce a downward (or upward) pressure on the Hawaii milk shed Class I milk price. The extend to which northern California Class I milk price is allowed to affect the price of Class I milk in the Hawaii milk shed can be accounted for with the **Conditional Pricing Formula**.

A. The Unconditional Pricing Formula (the Basic Formula)

The Unconditional Formula derives an unrestricted "new" minimum price producers should receive for each hundredweight of Class I milk sold. In the formula, let t represents the "new" month, then new Class I milk price per hundredweight can be represented by the following basic equation:

$$\textbf{(1)} \quad \mathbf{BIG1}_t = \mathbf{OC}_{base} + \mathbf{FC}_t + (\mathbf{OC}_{base} + \mathbf{FC}_t) \bullet \mathbf{RIA}_{t-2}$$

$$\mathbf{OC}_{base} = \mathbf{TC}_{base} - \mathbf{FC}_{base}$$

$$\mathbf{FC}_t = \mathbf{FC}_{base} \bullet ((\mathbf{HFCI}_t/\mathbf{HFCI}_{base\text{-}average} - 1) \bullet \mathbf{65\%} + \mathbf{1}),$$

Where $\mathbf{OC}_{base}$, $\mathbf{TC}_{base}$, and $\mathbf{FC}_{base}$ are the Other Costs, Total Cost, and reported Feed Cost, respectively, in the base year. Base year cost of production is defined as last year's average monthly cost of production. For example, the base year cost of production used for deriving a new price for any month in 2009 is an average monthly cost of production in 2008. Base year costs are to be calibrated annually in order to account for changes in the cost components not accounted for in the formula that adjusts price on a monthly basis. $\mathbf{FC}_t$ is the estimated Feed Cost

at time *t*. $\mathbf{HFCI}_t$ and $\mathbf{HFCI}_{base\text{-}average}$ are the Hawaii Feed Cost Index at time *t* and the average of base year monthly HFCI. This will be explained in detail below. A change in the $\mathbf{HFCI}_t$ has a 65 percent impact on the total feed cost;[12] such as a one percent increase in the $\mathbf{HFCI}_t$ has 0.65 percent impact on the total feed cost. $\mathbf{RIA}_{t\text{-}2}$ is the Rate of Investment Allowance two months prior to the new price being derived. For example, if the derivation of a new price is scheduled to become effective on the first day of June 2009, the $\mathbf{RIA}_{t\text{-}2}$ will represent an RIA for April 2009. The latest available RIA information has about a one month time lag. The derivation of a new milk price should be completed two weeks prior to the effective date. For example, if June 1st is the effective date for the new price, the derivation of the new price must be completed by May 15th, when the RIA for April is available.

As expressed in **equation (1)**, all cost components are aggregated and kept constant at the base year level with the exception of feed cost and the RIA. All other variables in this equation are straight forward, except for the variable FC, which is derived from the base year feed cost and the HFCI, which is updated monthly.

The **HFCI** is developed by using a composition of four different feed commodity prices and surface shipping cost, from northern California to Hawaii. The four feed commodity prices include corn (U.S. No. 2 Yellow), oat (U.S. No. 2 White), soybean meal (47% Protein), and alfalfa hay (Supreme). The price of each commodity is obtained from the USDA-AMS website, www.ams.usda.gov/, which is updated weekly.[13] The price is calculated in terms of dollars per hundred pounds for each commodity.

The total shipping cost used for developing the HFCI is comprised of seven components and each is calculated in terms of dollars per hundred pounds of feed shipped in a 40-foot container, equals to a 40,000 pound load. Horizon Lines shipping rates and fees are used as a proxy for shipping cost and the data is available from http://www.horizon-lines.com/News/Service-Bulletins.aspx.[14] The seven components include basic charge, fuel surcharge, terminal handling fee, wharfage fee at origin and at destination, neighbor island excise tax, and Hawaii invasive species tax. The basic charge, fuel surcharge, and terminal handling fee account for 89-92 percent of the total shipping cost. Basic charge is the largest component and accounts for 54-73 percent of the total shipping cost. In terms of price fluctuation, the basic charge and the terminal handling fee fluctuated less frequently than the fuel surcharge, which closely followed changes in fuel price. For example, from January 2005 to June 2009, basic charge and the terminal handling fee were adjusted three times and five times, respectively, while the fuel surcharge was adjusted from several times a month to once every two to five months. This was especially evident during high fuel price volatility in 2008. Other shipping cost components are constant.

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[12] On average, 55-65 percent of feed consumed by dairy cows was purchased and shipped to the Hawaii milk shed from the U.S. Mainland.

[13] Specific steps to be taken in the website to obtain the required data are explained in detail in the "GetData" page in the pricing program spreadsheet.

[14] Additional information, not reported in the announcement of rate changes, was obtained from the company's Customer Service Department at (808) 842-5300. Although there are two major interstate shippers in Hawaii that are used by the dairy industry for shipping milk and feed from the Mainland to Hawaii, Horizon and Matson Navigation, only shipping rates issued by Horizon are used because they are usually identical to those issued by Matson.

The Hawaii Feed Cost Index at time t ($\mathbf{HFCI}_t$) is the sum of the weighted Hawaii Feed Price Index at time t ($\mathbf{HFPI}_t$), derived from the weighted prices of four different feed ingredients, and the weighted Feed Shipping Cost Index at time t ($\mathbf{FSCI}_t$). This can be expressed as:

$$(2) \quad \mathbf{HFCI}_t = \mathbf{HFPI}_t/\mathbf{HFPI}_{base} \cdot (1 - w_{FSCI(t)}) + \mathbf{FSCI}_t/\mathbf{FSCI}_{base} \cdot w_{FSCI(t)}$$

$$(2.1) \quad \mathbf{HFPI}_t = \mathbf{Corn}_{average(t\text{-}0.5 \rightarrow t\text{-}1.5)} \cdot 0.275 + \mathbf{Oat}_{average(t\text{-}0.5 \rightarrow t\text{-}1.5)} \cdot 0.275 + \mathbf{Soy}_{average(t\text{-}0.5 \rightarrow t\text{-}1.5)} \cdot 0.175 + \mathbf{Alfalfa}_{average(t\text{-}0.5 \rightarrow t\text{-}1.5)} \cdot 0.275 ,$$

$$(2.2) \quad \mathbf{FSCI}_t = \mathbf{Basic}_{t\text{-}1} + \mathbf{Basic}_{t\text{-}1} \cdot \mathbf{FS}_{t\text{-}1} + (\mathbf{Terminal}_{t\text{-}1} + \mathbf{OakWharfage}_{t\text{-}1} + \mathbf{HiloWharfage}_{t\text{-}1} + \mathbf{NIETax}_{t\text{-}1}) \cdot 100/40{,}000 + \mathbf{InvasiveTax}_{t\text{-}1} \cdot 100/1{,}000$$

$$(2.3) \quad w_{FSCI(t)} = \mathbf{FSCI}_t/(\mathbf{HFPI}_t + \mathbf{FSCI}_t)$$

The variable $\mathbf{Corn}_{average(t\text{-}0.5 \rightarrow t\text{-}1.5)}$ is the average of weekly corn price, over a period of approximately four weeks. Other feed variables are defined in the same fashion as for corn. For example, $\mathbf{HFPI}_{june2009}$ would be developed by using price data for corn, oat, alfalfa hay, and soybean meal traded between the second half of April and first half of May. The variable **Basic** is the Basic Charge per hundred pounds of feed; **FS** is the Fuel Surcharge as a percent of the basic charge; **Terminal** is the Terminal Handling Fee per container; **OakWharfage** and **HiloWharfage** respectively are wharfage fees charged per container in Oakland, California, and in Hilo, Hawaii; **NIETax** is the Neighbor Island Excise Tax charged per container[15]; and **InvasiveTax** is the Hawaii Invasive Species Tax imposed on each 1,000 pounds of cargo shipped. It is assumed that each container carries 40,000 pounds of feeds. The $w_{FSCI(t)}$ is the weight of the $\mathbf{FSCI}_t$.

Therefore, the estimated feed cost ($\mathbf{FC}_t$) to be integrated into the $\mathbf{BIG1}_t$ equation for the derivation of a new milk price that will become effective on the first day of June 2009, would be equal to the monthly average feed cost in the base year ($\mathbf{FC}_{average2008}$), multiplied by 65 percent of the change in the HFCI in June 2009 from the average of HFCI in 2008. That is:

$$(3) \quad \mathbf{FC}_{june2009} = \mathbf{FC}_{average2008} \cdot ((\mathbf{HFCI}_{june2009}/\mathbf{HFCI}_{average2008} - 1) \cdot 65\% + 1)$$

[15] NIETax for animal feed is levied based on measured weight at $1 per ton. For simplicity, the measured weight charge for NIETax is converted into per container charge based on the assumption that 40,000 pounds of feed is shipped in a 40-foot container.

B. The Conditional Pricing Formula

The conditional pricing formula is composed of the basic formula as represented by **equation (1)**, with conditions to adjust for unconditional result. Thus, the **Conditional Pricing Formula** is written as:

(4) $\mathbf{BIG1}_{new} = \mathbf{OC}_{base} + \mathbf{FC}_t + (\mathbf{OC}_{base} + \mathbf{FC}_t) \bullet \mathbf{RIA}_{t-2}$,

Subject to condition:

(*i*) Northern California Basis (northern California Class I milk price + shipping cost from northern California to Hawaii)
(*ii*) Price stabilizer

The northern California Basis (condition *i*) forces results from the Unconditional Pricing Formula to respond to fluctuations in certain industry parameters accounted for by the northern California Basis. In doing so, it effectively forces the Hawaii milk shed price to be responsive to its major competitor. How responsive should the Hawaii milk shed price be to northern California Basis would depend on a policy choice, and instructions can be written into the formula to produce the desired result.

The price stabilizer (condition *ii*) is a value within the pricing formula that limits the range of price fluctuation. For example, if the price stabilizer is equal to five, the price is allowed to fluctuate not more than $5, either 1) above or below the breakeven basis, 2) above or below the price of the previous month, or 3) above the breakeven basis but not below it. The selection of one of the three conditions will depend on the policy choice. The **breakeven basis** is the direct unit cost of producing milk in the base year, which is equal to the total cost of production minus income not from milk sales (i.e., feed sales, sale of animals, revenue from equipment or land leases, interest income, etc.).

V. Deriving a New Price: An illustration

There are **three stages** of price derivation. The unconditional price is derived in the first stage. The unconditional price is adjusted in response to the behavior of the northern California Basis in the second stage. Finally, the price stabilizer is imposed to limit the range for price fluctuation in the third stage.

The specific conditions to be imposed on the equation depend on the preferred policy. For example, if price stability is the dominant policy choice, then a low price stabilizer would be assigned to limit the range within which price is allowed to fluctuate. However, if competitive pricing is the dominant policy choice, the unconditional result would be allowed to adjust toward the direction of northern California price and a price stabilizer would be either a large number or not be imposed at all.

Stage 1: The first stage of price derivation produces a breakeven price based on new cost of production, a dependent of feed cost and the RIA.

We begin by deriving the HFCI using **equation (2)**. The HFCI will be derived for June 2008 in this example. **Equation (2)** can be written as

$$\textbf{(5)}\quad \mathbf{HFCI}_{june2008} = \mathbf{HFPI}_{june2008}/\mathbf{HFPI}_{march2005} \cdot (1 - w_{FSCI(june2008)}) + \mathbf{FSCI}_{june2008}/\mathbf{FSCI}_{march2005} \cdot w_{FSCI(june2008)}$$

March 2005 is the starting point for all price indices.[16] First, we calculate the monthly HFPI for June 2008 using **equation (2.1)** and selected feed prices traded in California markets, as shown in Table 3. **Equation (2.1)** can be written as:

$$\textit{(6)}\quad \mathbf{HFPI}_{june2008} = \mathbf{Corn}_{average(Apr\ 15 \rightarrow May\ 14)} \cdot \mathbf{0.275} + \mathbf{Oat}_{average(Apr\ 15 \rightarrow May\ 14)} \cdot \mathbf{0.275} + \mathbf{Soy}_{average(Apr\ 15 \rightarrow May\ 14)} \cdot \mathbf{0.175} + \mathbf{Alfalfa}_{average(Apr\ 15 \rightarrow May\ 14)} \cdot \mathbf{0.275.}$$

Inserting data from Table 3 into **equation (6)** equals the following:

$$\begin{aligned}\mathbf{HFPI}_{june2008} &= ((12.69+12.76+12.25+12.33+12.98+13.06)/6) \cdot 0.275 && \text{(corn)}\\ &+ ((13.75+14.25+13.50+14.00+13.25+13.50)/6) \cdot 0.275 && \text{(oat)}\\ &+ (((375.30+379.80+382.20+386.70+382.20+386.70)/6)/20) \cdot 0.175 && \text{(soybean)}\\ &+ (((245+267+240+268+235+268+245+270)/8)/20) \cdot 0.275 && \text{(alfalfa)}\\ &= 12.68 \cdot 0.275 + 13.71 \cdot 0.275 + 19.11 \cdot 0.175 + 12.74 \cdot 0.275\\ &= 3.49 + 3.77 + 3.34 + 3.50\\ &= \mathbf{14.10}\end{aligned}$$

The average prices of soybean and alfalfa are further divided by 20 to convert them from dollars per ton (2,000 lbs), as they were reported, into dollars per hundred pounds as for corn and oat.

Next, we calculate the Feed Shipping Cost Index (**Equation (2.2)**) for June 2008:

$$\textbf{(7)}\quad \mathbf{FSCI}_{tjune2008} = \mathbf{Basic}_{may} + \mathbf{Basic}_{may} \cdot \mathbf{FS}_{may} + (\mathbf{Terminal}_{may} + \mathbf{WestWharfage}_{may} + \mathbf{HiloWharfage}_{may} + \mathbf{NIETax}_{may}) \cdot \mathbf{100/40{,}000} + \mathbf{InvasiveTax}_{may} \cdot \mathbf{100/1{,}000}$$

[16] March 2005 is set as the beginning period for all price indices because the earliest feed price data available is January 2005, which is used for the March index. The feed price index has a month and a half time lag.

Inserting data from Table 4 into **equation (7)** equals the following:

$$\begin{aligned}\mathbf{FSCI}_{june2008} &= 5.60 + 5.60 \bullet 33.75\% + (600 + 158 + 129.60 + 20) \bullet 100/40{,}000 \\ &\quad + 0 \bullet 100/1{,}000 \\ &= 5.60 + 1.89 + 2.27 + 0 \\ &= \mathbf{9.76}\end{aligned}$$

Results for **HFPI** and **FSCI** for other months and years are illustrated in Table 5.

The last variable needed to be calculated in order to derive a value for the $\mathbf{HFCI}_{june2008}$ is the weight variable that may vary monthly. This value is dependant on the relative combined feed price and shipping cost. Thus, the weight variable for June 2008 of the Feed Shipping Cost Index in **equation (2.3)** is written as:

$$(8) \qquad w_{FSCI(june2008)} = \mathbf{FSCI}_{june2008}/(\mathbf{HFPI}_{june2008} + \mathbf{FSCI}_{june2008})$$

Inserting values derived in **equations (6)** and **(7)** equals:

$$\begin{aligned}w_{FSCI(june2008)} &= 9.76/(14.10 + 9.76) \\ &= \mathbf{0.41}\end{aligned}$$

The values for $\mathbf{HFPI}_{march2005}$ and $\mathbf{FSCI}_{march2005}$ are calculated in the same manner as for $\mathbf{HFPI}_{june2008}$ and $\mathbf{FSCI}_{june2008}$. Inserting those values into **equation (5)** yields the **HFCI** for June 2008.

$$\begin{aligned}\mathbf{HFCI}_{june2008} &= 14.10/8.06 \bullet (1\text{-}0.41) + 9.76/7.20 \bullet 0.41 \\ &= 1.03 + 0.56 \\ &= \mathbf{1.59}\end{aligned}$$

The result suggests that the HFCI has increased 59 percent between March 2005 and June 2008. This demonstrates the combined increase in feed price of 75 percent (from $8.06 to $14.10) and an increase in shipping cost of 36 percent (from $7.20 to $9.76) which resulted in an overall increase in feed cost for the Hawaii milk shed producers by 59 percent. The HFCI results are summarized in Table 5 and illustrated in Figure 5 together with California's average feed cost per hundredweight of milk produced.

The next step is to estimate feed cost. If we estimate feed cost for June 2008, then the feed cost equation can be written as follows:

$$\textbf{(9)} \quad FC_{june2008} = FC_{average2007} \bullet ((HFCI_{june2008}/HFCI_{average2007} - 1) \bullet 65\% + 1)$$

Inserting the appropriate data into the equation equals:

$$\begin{aligned} FC_{june2008} &= 19.41 \bullet ((1.59/(1.15+1.15+1.18+1.22+1.20+1.22+1.25+1.28 \\ &\quad +1.26+1.27+1.30+1.32)/12 -1) \bullet 65\% +1) \\ &= 19.41 \bullet ((1.287 - 1) \bullet 65\% +1) \\ &= \mathbf{23.03} \end{aligned}$$

This cost is based on the assumption that the producer purchased 65 percent of feed and cultivated or grazed cows on pasture for the remaining 35 percent of the total feed in a given year. Therefore, only 65 percent of the feed cost is exposed to feed commodity price and shipping cost fluctuations. As an exercise, feed cost for other months, from January 2006 through June 2009, are estimated using the formula discussed and summarized in Table 6 together with other related variables. The estimated monthly feed cost is illustrated graphically and compared with the reported feed cost for the Hawaii milk shed (Figure 6) and with selected milk producing regions on the U.S. Mainland (Figure 7). The impact of feed commodity price and shipping cost fluctuations on feed cost at various percent exposures is estimated and summarized in Supplement Table 1, with a graphical illustration in Supplement Figure 1.

Now that all the necessary variables have been derived, the next step is to derive the "unconditional" minimum Class I price by plugging in those variables into **equation (1).** Our example is for June 2008. Thus, **equation (1)** becomes:

$$\textbf{(10)} \quad BIG1_{june2008} = OC_{2007} + FC_{june2008} + (OC_{2007} + FC_{june2008}) \bullet RIA_{april2008}$$

The average monthly breakeven basis for the base year 2007 is determined from the cost of production report, to be $32.24 per hundredweight.[17] The average monthly cost of other items in 2007 (OC_{2007}) is the difference between the breakeven basis and the average monthly feed cost ($19.41) as reported in the same year. Thus, OC_{2007} = $32.24 - $19.41 = $12.83. The June 2008 feed cost ($FC_{june2008}$) equals $23.03 (derived from equation 9) and the rate of investment allowance for April 2008 ($RIA_{april2008}$) is 6.97 percent. Inserting all known values into **equation (10)** equals the following:

[17] This was determined to be the average monthly total of the direct cost of production, which is equal to the average monthly total expenses minus the monthly average of other income not from the sale of milk ($32.96 - $0.74 = $32.24).

$$\mathbf{BIG1}_{june2008} = 12.83 + 23.03 + (12.83+23.03) \bullet 6.97\%$$
$$= \mathbf{38.36}$$

The $BIG1_{june2008}$ = $38.36 is the breakeven price for operation in June 2008, with the opportunity cost of investment included. The difference between the June 2008 breakeven price and the 2007 breakeven basis is attributable to two factors. The first is an increase of 19 percent in feed cost (from $19.41 to $23.03) and the second, a 6.97% RIA on investment ((12.83+23.03) • 6.97% = $2.50). Results for other months, from January 2006 through June 2009, are summarized in Supplement Table 2 and illustrated in Figure 8.

VI. Recommended Pricing Policy

Following considerations for the development of the pricing formula as mentioned throughout this report, it is recommended that:

- The Milk Control Section is entrusted with the full authority to adjust the Hawaii milk shed milk price on a monthly basis, two weeks prior to the effective date of the new price.

- The Hawaii milk shed price should be responsive to changes in the cost of production on a timely basis. The pricing formula should allow for adjustments based on the cost of production in order to limit losses by producers when input prices experience sustained and drastic increases.

- The Hawaii milk shed price should be responsive to competitive market condition in order to encourage local productivity.

Therefore, the recommended pricing formula policy is reflected in the illustration of price derivation in stages 2 and 3.

Stage 2: The second stage of price derivation ensures that the Hawaii milk shed price is competitive to some degree. Conditions for pricing in response to northern California are specified so that after the unconditional price is fully adjusted to reflect changes in the northern California milk price, the adjusted price will not be greater than the unconditional price itself. Thus, the pricing formula instruction within the spread sheet can be written in the following fashion:

Condition 1: If $BIG1_{Unconditional}$ + NCABasisAdjuster > $BIG1_{Unconditional}$, accept $BIG1_{Unconditional}$; otherwise, accept $BIG1_{Unconditional}$ + NCABasisAdjuster.

The "NCABasisAdjuster" is a one year month-to-month cumulative change in northern California Basis, starting in January 2006. Northern California Basis, as defined in **Condition (*i*), Equation 4 ($\mathbf{BIG1}_{new}$)**, is the northern California Class I price per hundredweight of milk plus shipping cost to Honolulu.

This instruction, "If $BIG1_{Unconditional}$ + NCABasisAdjuster > $BIG1_{Unconditional}$, accept $BIG1_{Unconditional}$", prevents Hawaii milk shed Class I price from rising beyond its unconditional level regardless of how high and rapid northern California Basis changes. With this instruction, the Hawaii milk shed Class I price is prohibited from rising above the breakeven level—a level of earning that makes a "*normal profit*". This will ensure and maintain some degree of competitiveness.[18] The incorporation of the instruction into the unconditional pricing formula (in the spreadsheet) for June 2008 yields:

$BIG1_{June2008\ (Condition\text{-}1)}$ = \$37.62.

Results for other months, from January through June 2009, are summarized in Supplement Table 2 and illustrated in Figure 9. The pricing that is conditioned to the northern California Class I price (BIG1 Conditional to NCA Basis) dropped dramatically towards the end of 2008, due to the downfall in the northern California Class I price. By June 2009, when the Unconditional price was calculated to be \$36.30, the formula produced \$31.43 as a price conditional to the NCA Basis, which is below the \$35.55 break even basis—the monthly average direct production cost in 2008.

While **Condition 1** sets the upper limit for a price adjustment equivalent to the new breakeven price, it does not prevent price from falling below a minimum level required for the financial survival of the dairy operation. If the proposed pricing model is based on the northern California milk price, pricing within the Hawaii milk shed can become financially unsustainable if this price base experiences deep drops over an extended period of time. In fact, northern California milk price, as well as prices in FMMO regions, has been under an extremely depressed condition since February 2009. The Northern California Class I milk price dropped from \$17.42/Cwt in January to \$11.27/Cwt in February, and by August 2009, the price remained at \$11.71/Cwt. Given this situation, an additional condition is needed to prevent the minimum price for the Hawaii milk shed from falling below the cost of production.

Stage 3: In the third stage, a price stabilizer is imposed to prevent price from rising or falling beyond a certain level.

While this stabilizer limits price from falling too far during times of market price depression, it also limits the extent to which price can adjust to rising cost. When the price of Hawaii's major competitor—the northern California milk—experiences sustained, depressed milk price, the stabilizer sets a minimum price that limits losses to producers in the Hawaii milk shed. However, because it also sets an upper limit for price, the extent to which price is allowed to increase may

[18] This breakeven price accounts for the opportunity cost of investment in a dairy operation, as represents by the RIA in Equation (4).

not be sufficient to allow for a full compensation for input cost when there is turbulence in the market. This situation would force producers to take steps to reduce cost and possibly absorb a limited loss during this period. Nonetheless, if a loss occurs, the difference between the breakeven price and the maximum price allowable by the stabilizer may be partially or entirely compensated for by the RIA—the *normal profit* rate, which accounts for the opportunity cost of resources invested in milk production. The RIA averaged 6.93 percent between January 2006 and June 2009.

It is recommended that the Hawaii milk shed Class I price, after adjustments for the northern California price change, is not allowed to fall below the Breakeven Basis—the per hundredweight direct cost of producing milk in the base year. Let $BIG1_{Condition\text{-}1}$ represents the result under the **Condition 1**, in the second stage of price derivation. Then, the instruction within the pricing formula (in the spreadsheet) can be written as follows:

Condition 2: If $BIG1_{Condition\text{-}1} < BIG1_{Break\text{-}Basis}$, accept $BIG1_{Break\text{-}Basis}$; however, if $BIG1_{Condition\text{-}1} > BIG1_{Break\text{-}Basis}$ + Stabilizer, accept $BIG1_{Break\text{-}Basis}$ + Stabilizer; otherwise accept $BIG1_{Condition\text{-}1}$.

The condition, "If $BIG1_{Condition\text{-}1} < BIG1_{Break\text{-}Basis}$, accept $BIG1_{Break\text{-}Basis}$", prevents price from falling below the breakeven basis—the direct cost of production in the base year. The condition, "however, if $BIG1_{Condition\text{-}1} > BIG1_{Break\text{-}Basis}$ + Stabilizer, accept $BIG1_{Break\text{-}Basis}$ + Stabilizer", prevents price from increasing too drastically.

With the instruction in Condition 2 incorporated into the pricing formula (in the spreadsheet) with the instruction in Condition 1 already in place, for June 2008, the formula yields:

$BIG1_{June2008\ (Condition\text{-}1\ +\ Stabilizer\ =\ 5)} = \$37.24.$

The results for other months, from January 2006 through June 2009, with both **Condition 1** and **Condition 2** incorporated into the formula are summarized in Supplement Table 2 and illustrated in Figure 10.

Fast forward to June 2009, the new pricing results generated by the formula for various conditions are as follows:

Unconditional Price:	$36.30
Price Conditional to NCA Basis:	$31.43
Price Conditional to NCA Basis and a Stabilizer value of 5:	**$35.55**
Breakeven Basis (2008 monthly average direct production cost):	$35.55
NCA Basis (northern California + shipping cost):	$24.81
Price under the existing fixed price system based on cost of production:	$35.53

VII. Conclusion

A historical lesson from the pricing policy implemented for the dairy industry in Hawaii suggests that neither a system that is based on the northern California Class I price (plus shipping cost) implemented for the Honolulu milk shed nor a fixed price system based on cost of production for the Hawaii milk shed has enable dairies to sustain operations. Although the pricing system is not the sole determinant of the decline in the dairy industry in Hawaii, it is a critical factor that can directly and indirectly determine the sustainability of a dairy operation.

Thus, a new price formula has been developed; it derives a monthly breakeven price for Class I fluid milk produced in the Hawaii milk shed. This breakeven price is equal to a unit cost of production plus the Rate of Investment Allowance (RIA), which follows the Moody's Seasoned Baa Corporate Bond Index. The RIA is included in the formula to account for opportunity cost of investing in the dairy operation. It can be referred to as a "*normal profit*" rate.

The price derived by the formula adjusts to the monthly changes in feed commodity prices (corn, oat, soy beans, and alfalfa hay), shipping cost of feed from the U.S. Mainland west coast to the Hawaii milk shed, and the RIA. Feed cost is the main driver of the new monthly price changes because of its dynamic nature and substantially large share in the total cost of production—more than 50 percent. Other cost variables (i.e., labor, leases, veterinarian and laboratory fees, insurances, etc.) are either relatively insignificant or stable throughout the year. Thus, in the formula, they are kept constant and adjusted only in January of each year.

Two conditions are imposed in the formula. The first condition is to force the unconditional price derived by the formula to respond to fluctuations in certain industry parameters accounted for by the northern California Basis. The second condition is to impose a price stabilizer that limits a range for the Hawaii milk shed's milk price to vary. The stabilizer keeps price from varying too drastically while preventing the new price to fall below the breakeven basis. This provides some protection to consumers in times of extreme input market turbulence and to limit the negative impact on producers during an industry-wide price depression that is beyond the control of individual producers. Thus, the final result of the price derivation is a price that accounts for changes in the new feed cost, opportunity cost of investment, and northern California Class I price while provide a certain level of price stability**. It is recommended that a new price is derived on a monthly basis, and the recommended stabilizer value is five.**

There are some limitations to this pricing formula. First, because the formula does not account for changes in all cost variables on a monthly basis, the price derived may be slightly lower or higher than the actual cost of production. Second, an annual adjustment on the breakeven basis, while bringing the total per unit cost in the formula closer to the actual cost, could cause a jump or drop in the new price for the month of January, if the new reported unit cost of production changed sharply from last year. This could occur as a result of changes in other cost variables and milk output per cow. Third, the imposition of a price stabilizer may force producers to take a price that is lower than the new and higher cost of production, when input cost substantially increased.

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Table 3. Sample of Selected Feed Prices Traded in California Markets

		Corn (Cal)		Oats			Soybean Meal			Hay (Northern Cal Alfalfa)	
		U.S. No. 2 Yellow		U.S. No 2 White			47 ½% Protein			Supreme	
		$/100 lbs		$/100 lbs			$/Ton			$/Ton	
Index Month	Data Date	Low	High	Low	High	Data Date	Low	High	Data Date	Low	High
...	...	...	...	...	...	...	...	...	...	...	...
Mar-2005	20050120	5.05	5.12	8.50	8.75	20050118	190.70	195.70	20050121		185.00
	20050127			8.50	8.75	20050125	200.90	204.90	20050128	179.00	192.00
	20050203	5.25	5.40	8.50	8.75	20050201	199.70	200.70	20050204		180.00
	20050210	5.20	5.30	8.50	8.75	20050208	189.50	191.50	20050211		
...	...	...	...	...	...	...	...	...	...	...	...
May-2008	20080320	11.12	11.40	13.75	14.25	20080318	351.00	354.50	20080321	250.00	265.00
	20080327	11.75	11.99	13.75	14.25	20080325	374.30	375.80	20080328	235.00	268.00
	20080403	12.35	12.70	13.75	14.25	20080401	353.50	356.50	20080404	245.00	268.00
	20080410	12.45	12.59	13.75	14.25	20080408	357.30	359.80	20080411	240.00	268.00
Jun-2008	20080417	12.69	12.76	13.75	14.25	20080415	375.30	379.80	20080418	245.00	267.00
	20080424	12.25	12.33	13.50	14.00	20080422	382.20	386.70	20080425	240.00	268.00
	20080501	12.98	13.06	13.25	13.50	20080429	382.20	386.70	20080502	235.00	268.00
	20080508					20080506			20080509	245.00	270.00

Data Source: USDA-AMS, at www.ams.usda.gov/.

Table 4. Horizon Shipping Rates and Fees from Oakland, California, to Hilo, Hawaii, Selected Dates[a]

	Fuel Surcharge Rate	Basic Charge	Terminal Fee	Oakland Wharfage	Hilo Wharfage	Neighbor Island Excise Tax	Hawaii Invasive Species Tax
	%Basic	$/Cwt	$/Container	$/Container	$/Container	$/Container[b]	$/1,000 lbs
Dec-05	13.00	5.28	265.00	158.00	129.60	20.00	
Jan-06	13.00	5.28	265.00	158.00	129.60	20.00	
…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…
May-08	33.75	5.60	600.00	158.00	129.60	20.00	
Jun-08	33.75	5.60	600.00	158.00	129.60	20.00	
Jul-08	33.75	5.60	600.00	158.00	129.60	20.00	0.50
Aug-08	38.25	5.60	600.00	158.00	129.60	20.00	0.50
Sep-08	38.25	5.60	600.00	158.00	129.60	20.00	0.50
Oct-08	42.25	5.60	600.00	158.00	129.60	20.00	0.50
Nov-08	32.50	5.60	600.00	158.00	129.60	20.00	0.50
Dec-08	19.83	5.60	600.00	158.00	129.60	20.00	0.50
Jan-09	15.00	5.60	600.00	158.00	129.60	20.00	0.50
Feb-09	15.00	5.82	775.00	158.00	129.60	20.00	0.50
Mar-09	15.00	5.82	775.00	158.00	129.60	20.00	0.50
Apr-09	15.00	5.82	775.00	158.00	129.60	20.00	0.50
May-09	15.00	5.82	775.00	158.00	129.60	20.00	0.50
Jun-09	16.50	5.82	775.00	158.00	129.60	20.00	0.50

[a] Data appear in the table have one month lag. For instance, a Fuel Surcharge of 16.5% of Basic Charge corresponding to June 2009 was actually started in May 2009. [b] Converted from a charge of $1/ton on a 40-foot container filled with 20 tons of combined feed types. Data Source: Shipping rates and fees are obtained from Horizon Lines, Customer Service Department, and from http://www.horizon-lines.com/News/Service-Bulletins.aspx. See footnote 14 for more explanations on data source.

Table 5. Hawaii Feed Cost Index.

	Corn (Share: 0.275)	**Oat** (Share: 0.275)	**Soy Bean Meal** (Share: 0.175)	**Alfalfa Hay** (Share: 0.275)	**Hawaii Feed Price Index** $/Cwt	**Feed Shipping Cost Index** ($/Cwt)	**Feed Cost Index** (March 2005 = 1)
Mar-05	1.44	2.37	1.72	2.53	8.06	7.20	1.00
...	...	...	...	...	...	...	...
Dec-05	1.44	2.41	1.75	2.87	8.46	7.40	1.04
...	...	...	...	...	...	...	...
Dec-06	2.15	2.60	1.88	2.55	9.17	8.04	1.13
...	...	...	...	...	...	...	...
Dec-07	2.24	3.54	2.71	3.07	11.57	8.39	1.32
Jan-08	2.24	3.54	2.71	3.07	11.57	8.97	1.35
Feb-08	2.84	3.64	3.27	3.33	13.09	9.49	1.50
Mar-08	2.99	3.90	3.20	3.47	13.56	9.63	1.54
Apr-08	3.31	3.85	3.40	3.51	14.07	9.63	1.58
May-08	3.31	3.85	3.15	3.50	13.82	9.76	1.57
Jun-08	3.49	3.77	3.34	3.50	14.10	9.76	1.59
Jul-08	3.66	3.71	3.29	3.56	14.22	9.81	1.60
Aug-08	4.14	3.85	4.06	3.73	15.78	10.06	1.74
Sep-08	3.40	3.92	3.65	3.73	14.71	10.06	1.65
Oct-08	3.39	3.88	3.42	3.66	14.35	10.29	1.63
Nov-08	2.98	3.83	2.85	3.66	13.32	9.74	1.53
Dec-08	2.56	3.78	2.62	3.52	12.48	9.03	1.43
Jan-09	2.38	3.71	2.57	3.21	11.87	8.76	1.36
Feb-09	2.49	3.51	2.78	3.31	12.08	9.45	1.42
Mar-09	2.41	3.51	2.99	3.06	11.96	9.45	1.41
Apr-09	2.35	3.51	2.85	2.84	11.55	9.45	1.38
May-09	2.47	3.40	2.94	2.29	11.11	9.45	1.35
Jun-09	2.52	3.01	3.23	2.17	10.93	9.54	1.34

Figure 5.

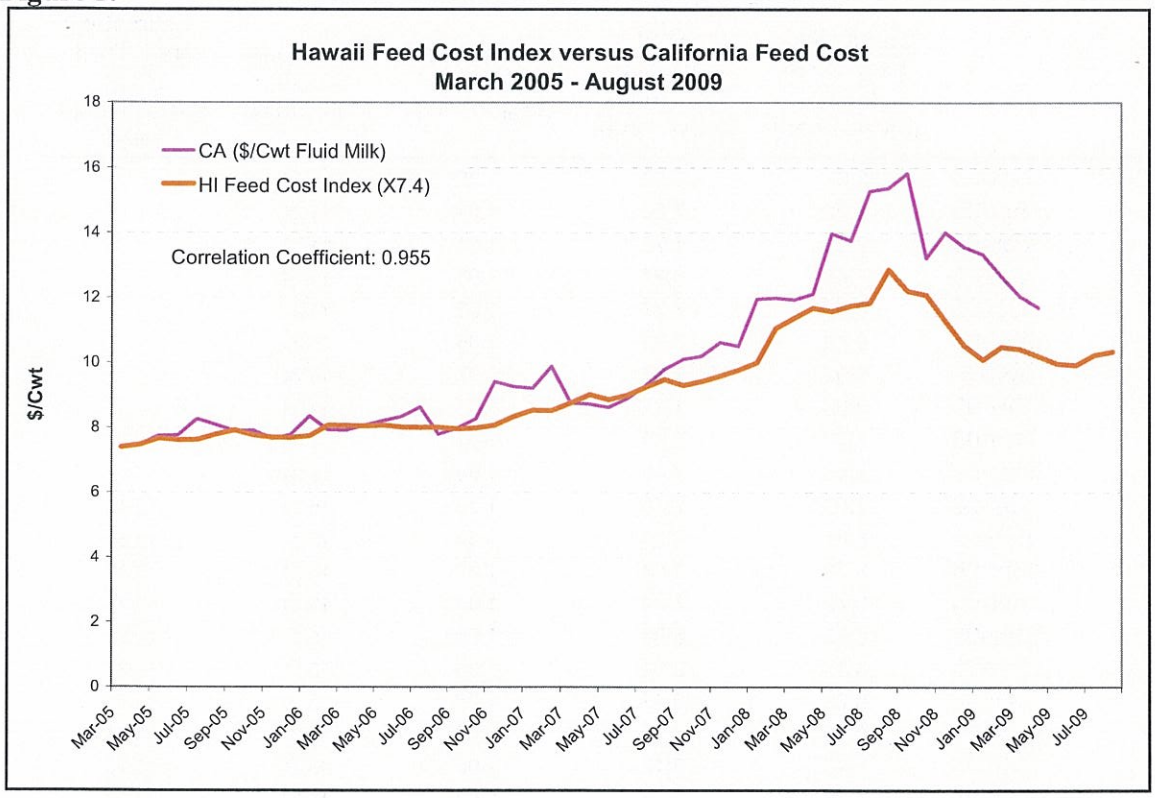


Figure 5 shows movements of HFCI with those of California's average feed cost per hundredweight of milk produced. In Figure 5, every HFCI point is multiplied by 7.40 in order to equalize the starting point of the HFCI to that of the California average feed cost per hundredweight of milk. Figure 5 suggests that HFCI is highly correlated with California's average feed cost movements, with a simple correlation coefficient of 0.955. The HFCI accounts for combined feed prices of corn, oat, soybean meal, and alfalfa hay at the point of purchase in northern California and the shipping cost from Oakland, California, to Hilo, Hawaii.

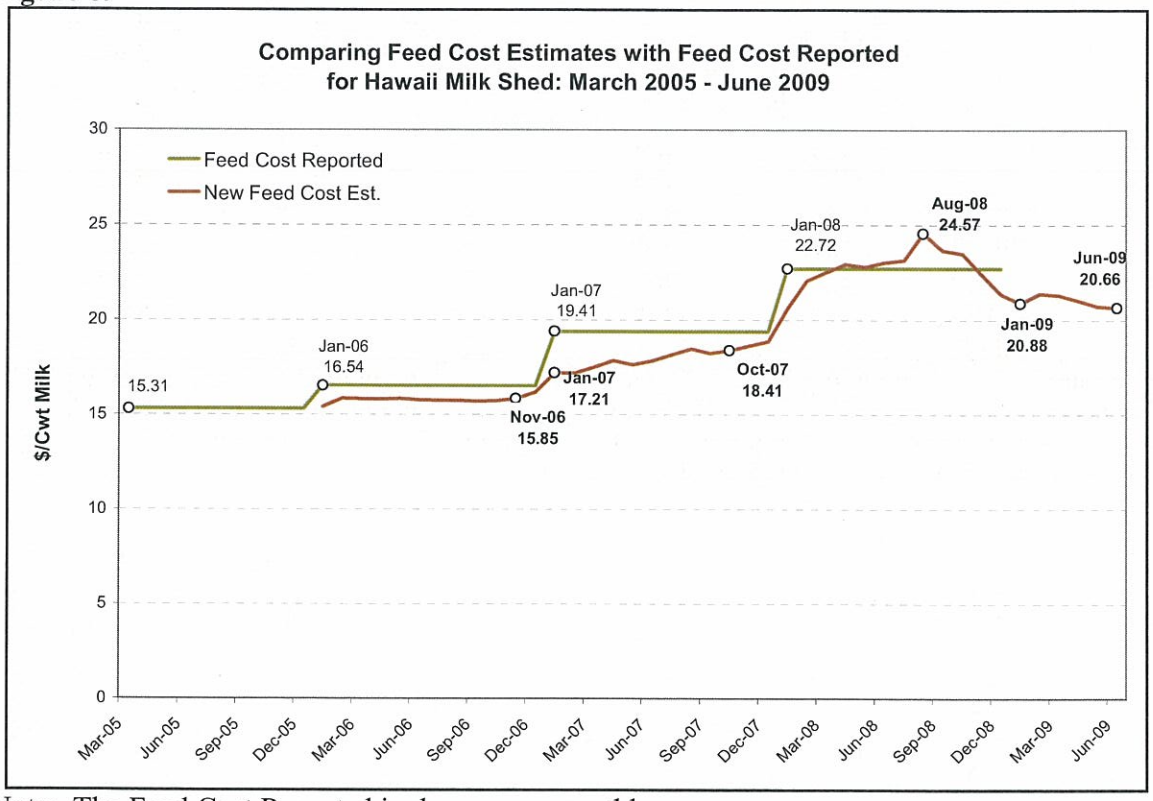
Table 6. Estimated Cost per Hundredweight of Feed for the Hawaii Milk Shed

	Composite Feed Price Index ($/Cwt Feed)	Feed Shipping Cost Index ($/Cwt Feed)	Hawaii Feed Cost Index (Mar '05 = 1)	Base Years ($/Cwt Liquid Milk)	Estimated New Feed Cost* ($/Cwt Liquid Milk)
Mar-05	8.07	7.20	1.00	14.24	
Apr-05	8.22	7.20	1.01	14.24	
May-05	8.55	7.27	1.04	14.24	
Jun-05	8.43	7.27	1.03	14.24	
Jul-05	8.45	7.27	1.03	14.24	
Aug-05	8.72	7.32	1.05	14.24	
Sep-05	8.97	7.32	1.07	14.24	
Oct-05	8.68	7.32	1.05	14.24	
Nov-05	8.47	7.40	1.04	14.24	
Dec-05	8.46	7.40	1.04	14.24	
Jan-06	8.56	7.40	1.05	15.31	15.41
Feb-06	8.81	7.84	1.09	15.31	15.84
Mar-06	8.78	7.84	1.09	15.31	15.82
Apr-06	8.76	7.84	1.09	15.31	15.81
May-06	8.62	8.03	1.09	15.31	15.85
Jun-06	8.48	8.03	1.08	15.31	15.77
Jul-06	8.29	8.18	1.08	15.31	15.75
Aug-06	8.30	8.18	1.08	15.31	15.76
Sep-06	8.20	8.18	1.08	15.31	15.70
Oct-06	8.26	8.18	1.08	15.31	15.73
Nov-06	8.55	8.10	1.09	15.31	15.85
Dec-06	9.17	8.04	1.13	15.31	16.19
Jan-07	9.55	8.04	1.15	16.54	17.21
Feb-07	9.60	7.97	1.15	16.54	17.21
Mar-07	10.04	7.97	1.18	16.54	17.52
Apr-07	10.44	8.08	1.22	16.54	17.87
May-07	10.15	8.08	1.20	16.54	17.66
Jun-07	10.32	8.20	1.22	16.54	17.84
Jul-07	10.73	8.25	1.25	16.54	18.17
Aug-07	11.16	8.25	1.28	16.54	18.49
Sep-07	10.78	8.33	1.26	16.54	18.25
Oct-07	10.99	8.33	1.27	16.54	18.41
Nov-07	11.26	8.39	1.30	16.54	18.64
Dec-07	11.57	8.39	1.32	16.54	18.88
Jan-08	11.57	8.97	1.35	19.41	20.62
Feb-08	13.09	9.49	1.50	19.41	22.08
Mar-08	13.56	9.63	1.54	19.41	22.52
Apr-08	14.07	9.63	1.58	19.41	22.94
May-08	13.82	9.76	1.57	19.41	22.80
Jun-08	14.10	9.76	1.59	19.41	23.03
Jul-08	14.22	9.81	1.60	19.41	23.15
Aug-08	15.78	10.06	1.74	19.41	24.57
Sep-08	14.71	10.06	1.65	19.41	23.67
Oct-08	14.35	10.29	1.63	19.41	23.49
Nov-08	13.32	9.74	1.53	19.41	22.39

	Composite Feed Price Index ($/Cwt Feed)	Feed Shipping Cost Index ($/Cwt Feed)	Hawaii Feed Cost Index (Mar '05 = 1)	Base Years ($/Cwt Liquid Milk)	Estimated New Feed Cost* ($/Cwt Liquid Milk)
Dec-08	12.48	9.03	1.43	19.41	21.35
Jan-09	11.87	8.76	1.36	22.72	20.88
Feb-09	12.08	9.45	1.42	22.72	21.38
Mar-09	11.96	9.45	1.41	22.72	21.30
Apr-09	11.55	9.45	1.38	22.72	21.02
May-09	11.11	9.45	1.35	22.72	20.73
Jun-09	10.93	9.54	1.34	22.72	20.66

Notes: * Monthly feed prices and shipping costs have a 65% impact on the estimated monthly feed cost in any given year. This assumption is based on the fact that feed purchased accounted for 55-65% of total feed used. The monthly average feed cost for 2008 base year, which is used for estimating the monthly feed cost in 2009, is estimates due to unavailable reported cost of production for 2008.

Figure 6.



Note: The Feed Cost Reported is shown as a monthly average.

Figure 6 compares the estimated feed cost (New Feed Cost Est.) that adjusts monthly with the reported average monthly feed cost (Feed Cost Reported). The 2008 average monthly cost in the Feed Cost Reported line is an estimate due to unavailable cost of production data for 2008.[19] As illustrated in the figure, a series of feed cost increases began after November 2006, due to increases in feed commodity prices and shipping cost. However, the estimated monthly feed cost remained lower than the reported monthly average feed cost throughout 2006 and 2007. It is because prices of feed commodities and shipping cost, which are accounted for in the formula, did not increase enough to raise the estimated feed cost to match with the reported cost (which was released after the fact). Other factors that could affect per unit feed cost that are not accounted for in the formula include milk output per cow, which has a direct effect on the monthly feed cost per hundredweight of milk produced, and possibly an accounting matter (i.e., adjustments for previous omissions, etc.). In the formula, the estimated new feed cost changes only if the HFCI changes. In 2006, the whole-year average HFCI increased 4.8 percent and in 2007, 13.7 percent, while the reported average monthly feed cost increased 8.0 percent in 2006, from $15.31 in 2005 to $16.54, and 17.4 percent in 2007.

[19] The estimation was accomplished using the new pricing formula.

Figure 7.

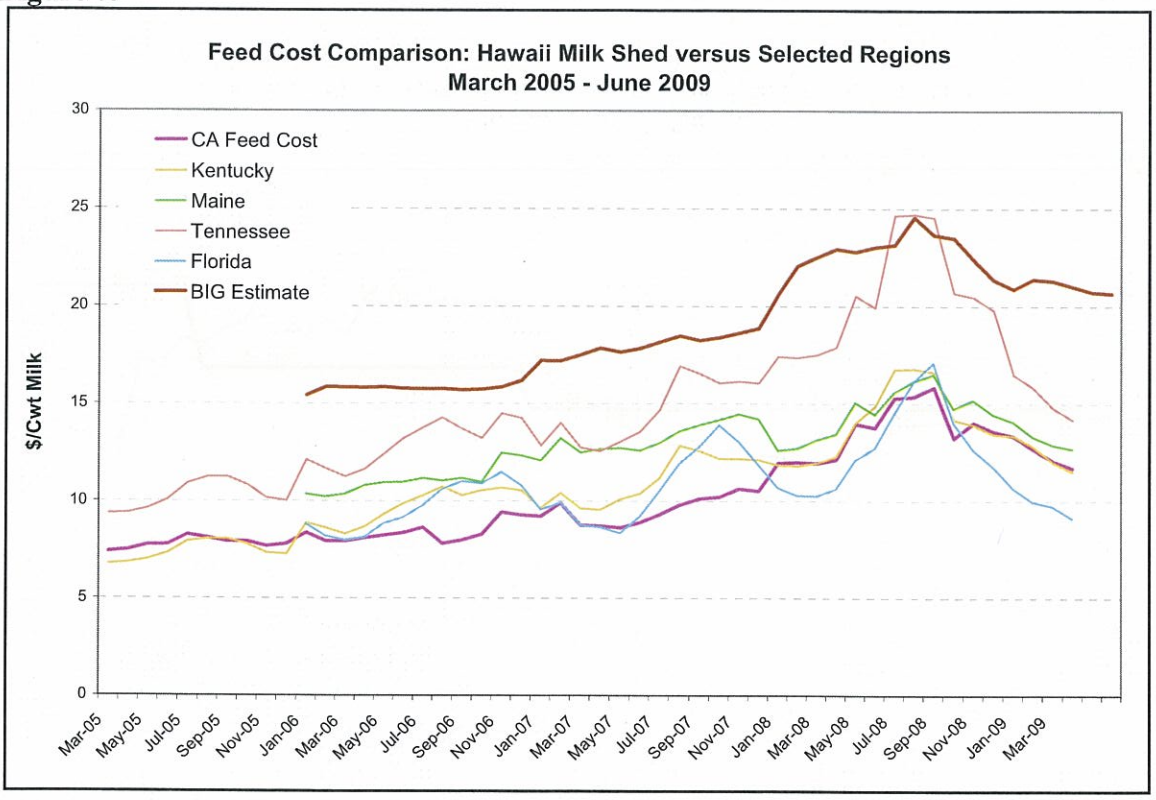


Figure 7 shows estimated feed cost per hundred pounds of milk produced in the Hawaii milk shed and other selected regions on the U.S. Mainland. The Hawaii milk shed feed cost (Big Estimate) is consistently higher than regions on the U.S. Mainland (January 2006 – June 2009). The exceptions are for the months of July and September in 2008, when Tennessee surpassed Hawaii's feed cost.

Figure 8.

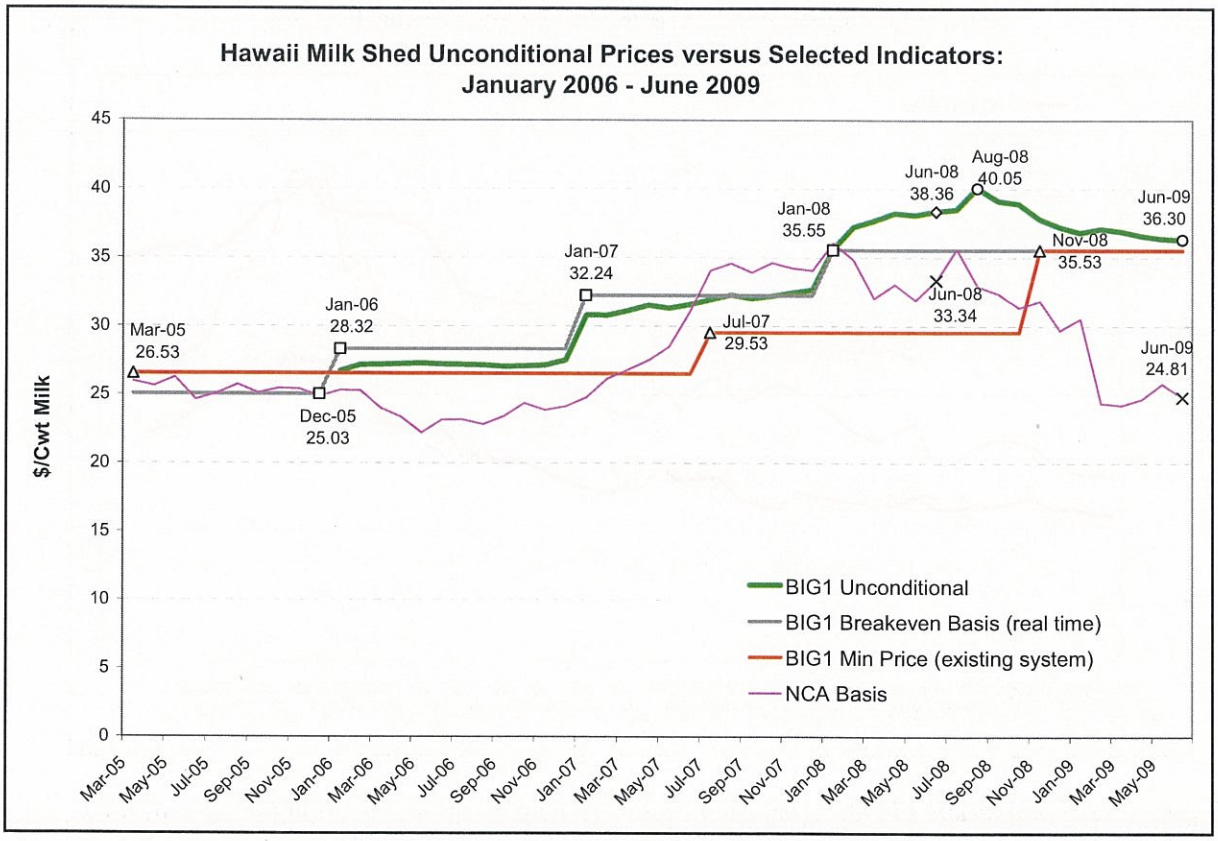


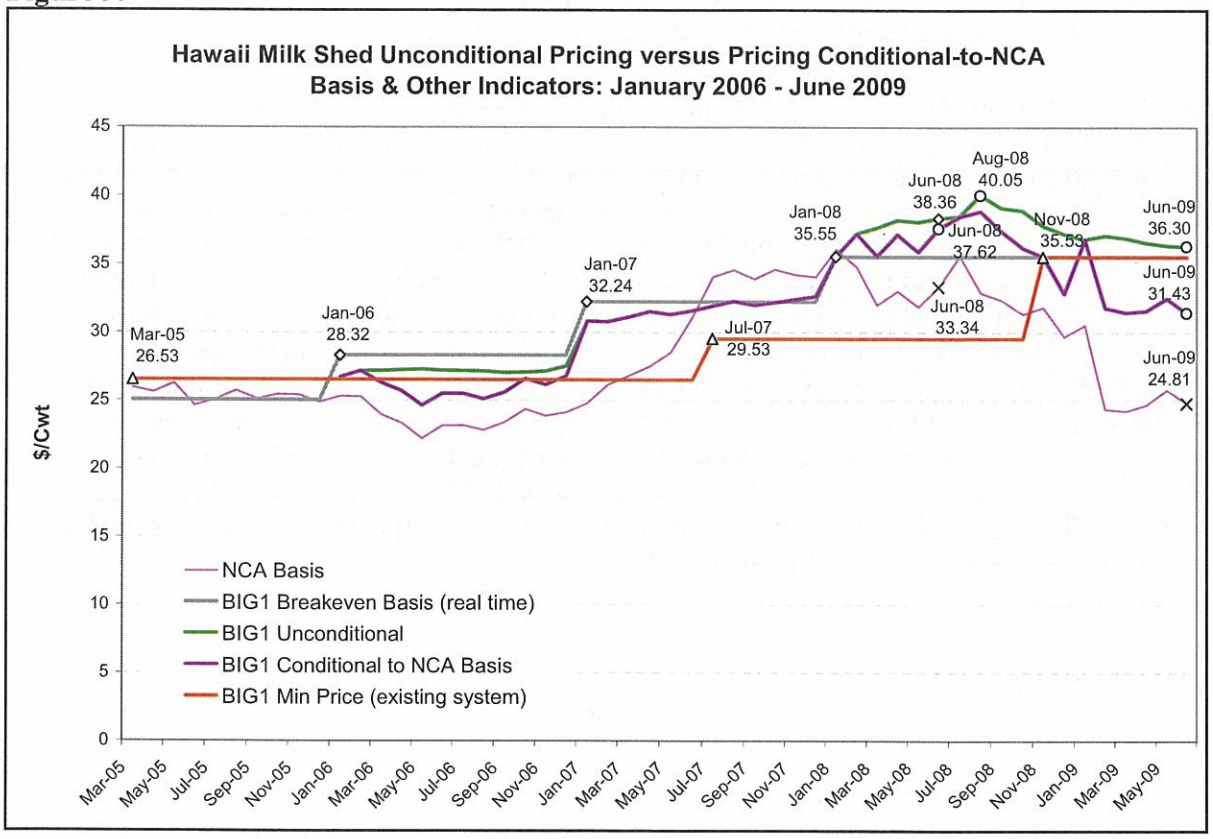
Figure 8 illustrates the monthly unconditional price derived by the equation **BIG1 Unconditional**, from January 2006 through June 2009. This graph is compared with the northern California Basis (NCA Basis), monthly average cost of production (Breakeven Basis - real time), and the Big Island Class I minimum prices under the existing policy (BIG1 Min. Price - existing system). The BIG1 Unconditional graph is a resemblance of the feed cost line (BIG Estimate) in Figure 7, because monthly price changes are mainly driven by changes in feed cost.

Figure 8 clearly shows that the monthly adjusted price generated by the formula (BIG1 Unconditional) runs consistently close to the reported cost of production (BIG1 Breakeven Basis – real time) and above that of the minimum price established under the existing system. In other words, the proposed pricing formula allows for flexibility in adjusting price as needed in order to reflect the cost of production. The BIG1 Unconditional generated milk price appears relatively stable in 2006, due to stable feed commodity prices and shipping cost. However, BIG1 Unconditional jumped from $27.53 in December 2006 to $30.83 in January 2007 as a result of cost of production adjustments for base year cost from $25.03 in 2005 to $28.32 in 2006. This is in combination with an increase in feed cost from $16.19 in December 2006 to $17.21 in January 2007. Cost of production continued to rise from November 2006, causing the unconditional minimum price generated by the formula to also rise. When feed cost peaked in August 2008, the unconditional minimum price generated by the pricing formula also peaked at $40.05.

Subsequently, feed prices and shipping cost declined, causing feed cost for producers and, hence, the unconditional minimum price to fall to $36.30 by June 2009.

Figure 8 also reveals that producers were operating under a loss for the entire period from January 2006 through October 2008, a period during which the cost of production (BIG1 Breakeven Basis – real time) was running above the minimum price in the existing system (BIG Class I Min Price – existing system). Although the Hawaii milk shed minimum price was increased from $26.53 to $29.53 in July 2007, it was insufficient to cover the cost of production. The Hawaii milk shed minimum price was increased to $35.53 in November 2008, surpassing the 2007 base year cost of production ($32.24). Nonetheless, this increase was still slightly insufficient to reverse losses incurred during the previous years. **The new price formula estimated that the average monthly direct cost of producing milk in the Hawaii milk shed in 2008 was $35.55.** This is an estimate using the unconditional pricing formula without the RIA included. However, when the RIA is included, the model suggests that the price that would be required for recovering the real cost of producing milk in 2008 would be a monthly average price of $38.06. The impact of the RIA on the monthly milk price is summarized in Supplement Table 2, with a graphical illustration in Supplement Figure 2.

Figure 9.



In Figure 9, the pricing result of incorporating the instruction in **Condition 1** into the unconditional pricing formula is compared with the northern California Basis and other relevant pricing conditions.

Figure 10.

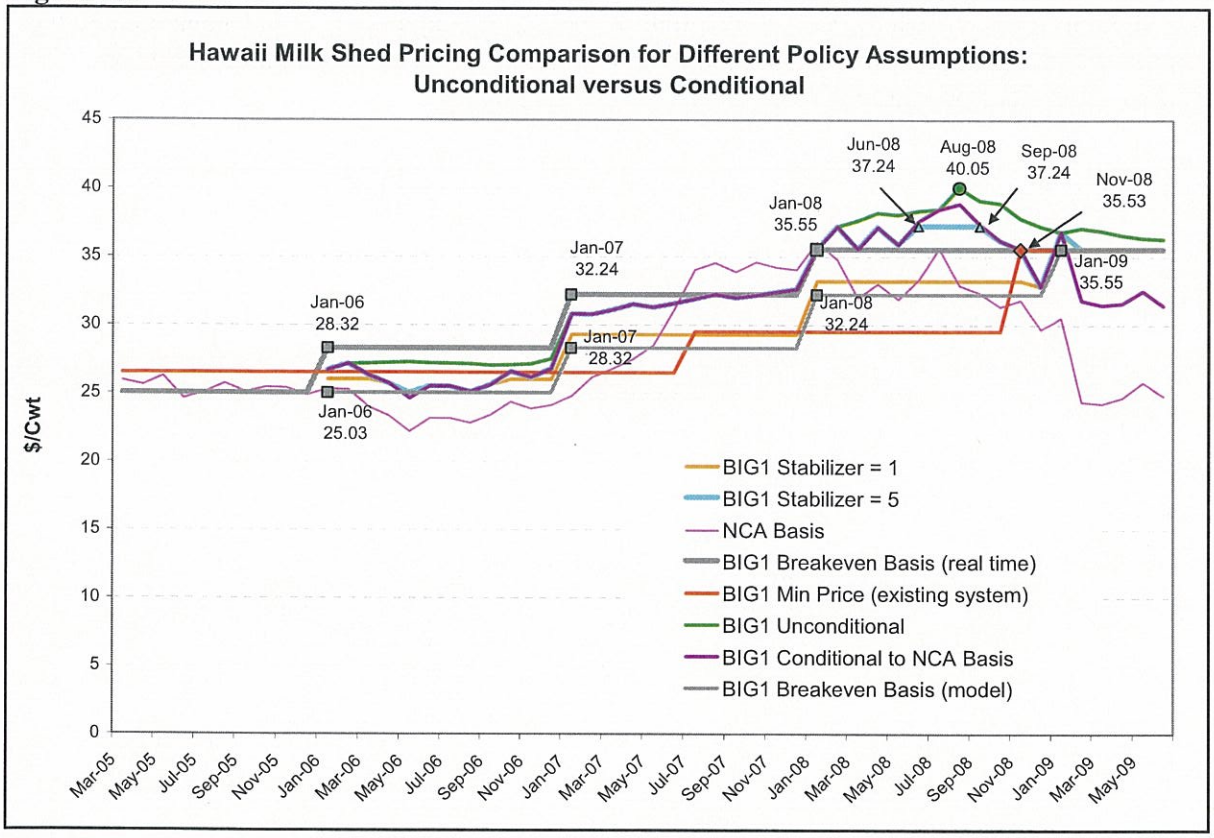


Figure 10 illustrates the pricing formula results when both **Condition 1** and **Condition 2** are in place. Two different price stabilizers are experimented, 1 and 5, and the results are illustrated in Figure 10. Detailed numerical results are summarized in Supplement Table 2. The margin for the new price to fluctuate around the breakeven basis is reduced with a small price stabilizer value. This is shown by the difference between the price with a stabilizer value of 1 and another with a stabilizer value of 5. With a stabilizer of 1 (orange line), the price generated by the formula for 2008 would not exceed $33.24 ($1 above the breakeven basis of $32.24). In the same year, the price generated by the formula with a stabilizer of 5 would not exceed $37.24 ($5 above the breakeven basis). This is illustrated in Figure 10 by the blue line (BIG1 Stabilizer = 5) from June through September 2008, when feed cost increased most substantially.

The sharp drop in the price generated by the formula for December 2008 requires an explanation. In December 2008, the price generated by the formula with a prize stabilizer of 5 dropped to $32.82 (hidden behind the purple line: "Big1 Conditional to NCA Basis), due to the decline in both the northern California price and feed cost. The December 2008 price is derived based on the 2007 breakeven basis of $32.24, a point at which the new price for any month in 2008 is not allowed to fall below.[20] The breakeven basis was increased to $35.55, as a result of increased cost of production in 2008, for deriving the 2009 monthly price. As a result of the breakeven basis adjustment, the January 2009 price generated by the formula increased to $36.81. This

[20] The previous year's monthly average breakeven basis is served as the lowest allowable new minimum price simply because the current year's breakeven basis will not be known until the end of the year.

increase was also partially contributed by the increases in the northern California price and the RIA. In February, the northern California price collapsed, causing the new price generated by the formula to fall and settle at the minimum allowable for 2009—the 2008 breakeven basis of $35.55—from February through June, as illustrated in Figure 10.

Supplemental Notes:

Northern California Class 1 Price (NCA1), adjusted monthly by CDFA Dairy, is a function of variables that are responsive to dairy market conditions. These variables include the daily adjusted

- Simple average spot price of Grade AA butter traded in the Chicago Mercantile Exchange (CME),
- Simple average spot price of block Cheddar cheese traded in the Chicago Mercantile Exchange (CME),
- California weighted average price for nonfat dry milk reported by the California Department of Food and Agriculture,
- Simple average of the mostly price of Western Dry Whey reported by Dairy Market News,
- Other pre-determined variables called "Adjusters".

NCA1 price is standardized based on 3.5% butter fat and 8.7% solid-non-fat (SNF). NCA1 is also subject to increase for any month the Milk Producers Security Trust Fund is collected, by $0.0017/lb of fat, $0.0009/lb of SNF, and $0.0001/lb of carrier. The NCA1 is normally announced in the *Minimum Class Price Letter*, available online, on the tenth day of the month and apply to the subsequent month. Information can be obtained at http://www.cdfa.ca.gov/dairy/min_priceletters_main.html.

Supplement Table 1.

New Feed Cost Estimates
At Various Percentage Shares of Imported Feed Purchased

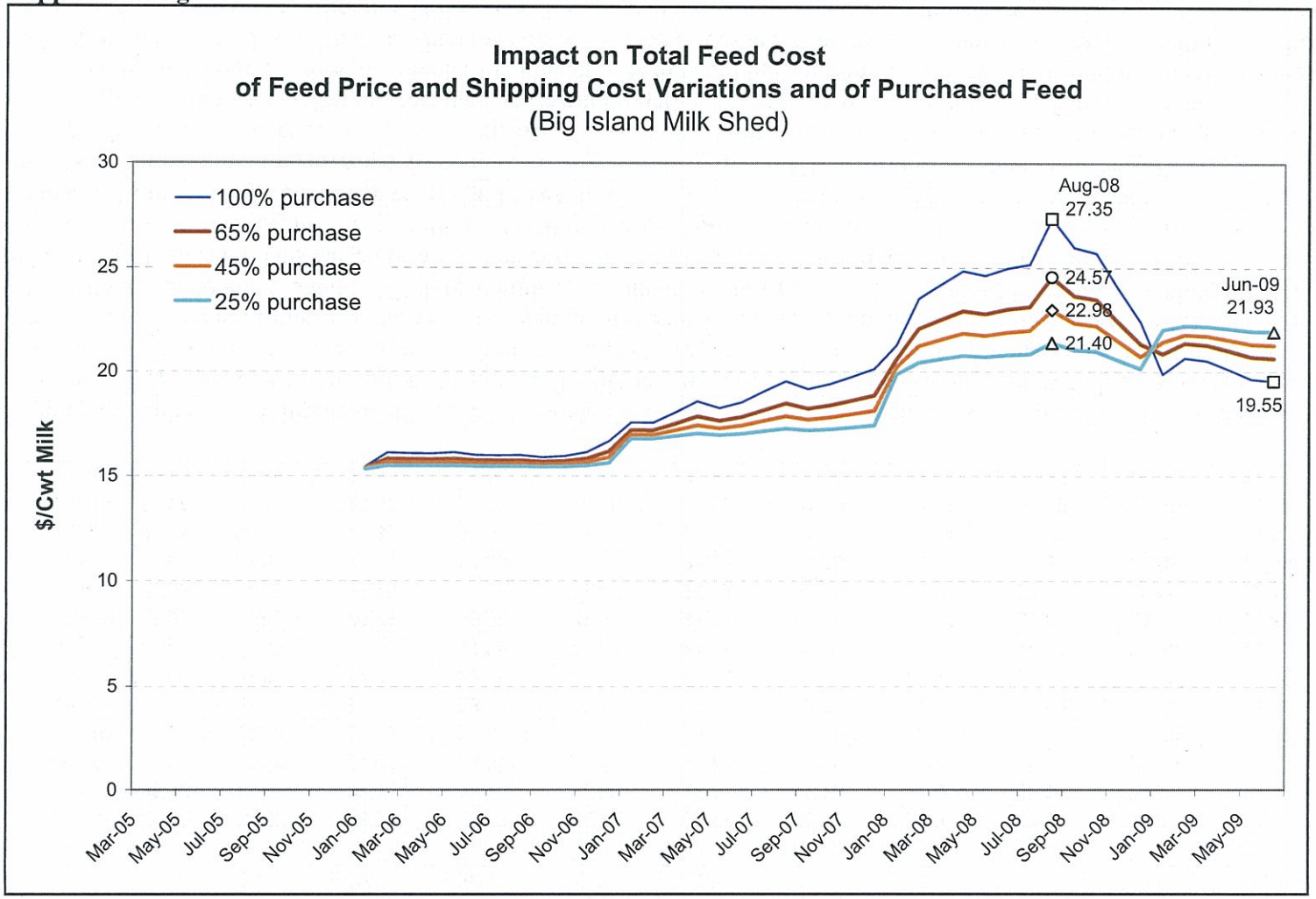
	100%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%
							$/Cwt					
Jan-06	15.46	15.42	15.42	15.41	15.40	15.39	15.39	15.38	15.37	15.36	15.36	15.35
Feb-06	16.13	15.92	15.88	15.84	15.80	15.76	15.72	15.68	15.64	15.60	15.56	15.51
Mar-06	16.10	15.90	15.86	15.82	15.78	15.74	15.70	15.66	15.63	15.59	15.55	15.51
Apr-06	16.08	15.89	15.85	15.81	15.77	15.73	15.69	15.66	15.62	15.58	15.54	15.50
May-06	16.13	15.93	15.89	15.85	15.80	15.76	15.72	15.68	15.64	15.60	15.56	15.52
Jun-06	16.01	15.84	15.80	15.77	15.73	15.70	15.66	15.63	15.59	15.56	15.52	15.49
Jul-06	15.99	15.82	15.79	15.75	15.72	15.68	15.65	15.62	15.58	15.55	15.51	15.48
Aug-06	16.00	15.83	15.80	15.76	15.73	15.69	15.66	15.62	15.59	15.55	15.52	15.48
Sep-06	15.91	15.76	15.73	15.70	15.67	15.64	15.61	15.58	15.55	15.52	15.49	15.46
Oct-06	15.96	15.80	15.77	15.73	15.70	15.67	15.64	15.60	15.57	15.54	15.51	15.47
Nov-06	16.14	15.94	15.89	15.85	15.81	15.77	15.73	15.69	15.64	15.60	15.56	15.52
Dec-06	16.67	16.33	16.26	16.19	16.13	16.06	15.99	15.92	15.85	15.79	15.72	15.65
Jan-07	17.58	17.32	17.27	17.21	17.16	17.11	17.06	17.01	16.95	16.90	16.85	16.80
Feb-07	17.57	17.31	17.26	17.21	17.16	17.10	17.05	17.00	16.95	16.90	16.85	16.80
Mar-07	18.05	17.67	17.60	17.52	17.44	17.37	17.29	17.22	17.14	17.07	16.99	16.92
Apr-07	18.58	18.07	17.97	17.87	17.76	17.66	17.56	17.46	17.36	17.25	17.15	17.05
May-07	18.26	17.83	17.74	17.66	17.57	17.49	17.40	17.31	17.23	17.14	17.06	16.97
Jun-07	18.55	18.04	17.94	17.84	17.74	17.64	17.54	17.44	17.34	17.24	17.14	17.04
Jul-07	19.05	18.42	18.30	18.17	18.05	17.92	17.80	17.67	17.55	17.42	17.29	17.17
Aug-07	19.54	18.79	18.64	18.49	18.34	18.19	18.04	17.89	17.74	17.59	17.44	17.29
Sep-07	19.18	18.52	18.38	18.25	18.12	17.99	17.86	17.73	17.59	17.46	17.33	17.20
Oct-07	19.42	18.70	18.55	18.41	18.27	18.12	17.98	17.83	17.69	17.55	17.40	17.26
Nov-07	19.78	18.97	18.81	18.64	18.48	18.32	18.16	18.00	17.83	17.67	17.51	17.35
Dec-07	20.14	19.24	19.06	18.88	18.70	18.52	18.34	18.16	17.98	17.80	17.62	17.44
Jan-08	21.27	20.81	20.71	20.62	20.53	20.43	20.34	20.25	20.15	20.06	19.97	19.88
Feb-08	23.51	22.49	22.28	22.08	21.87	21.67	21.46	21.26	21.05	20.85	20.64	20.44
Mar-08	24.20	23.00	22.76	22.52	22.28	22.05	21.81	21.57	21.33	21.09	20.85	20.61
Apr-08	24.84	23.49	23.21	22.94	22.67	22.40	22.13	21.86	21.58	21.31	21.04	20.77
May-08	24.62	23.32	23.06	22.80	22.54	22.28	22.02	21.76	21.49	21.23	20.97	20.71

New Feed Cost Estimates
At Various Percentage Shares of Imported Feed Purchased

	100%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%
							$/Cwt					
Jun-08	24.98	23.59	23.31	23.03	22.75	22.47	22.19	21.92	21.64	21.36	21.08	20.80
Jul-08	25.16	23.72	23.44	23.15	22.86	22.57	22.29	22.00	21.71	21.42	21.14	20.85
Aug-08	27.35	25.37	24.97	24.57	24.17	23.78	23.38	22.98	22.59	22.19	21.79	21.40
Sep-08	25.96	24.32	24.00	23.67	23.34	23.01	22.69	22.36	22.03	21.70	21.38	21.05
Oct-08	25.69	24.12	23.80	23.49	23.18	22.86	22.55	22.24	21.92	21.61	21.29	20.98
Nov-08	24.00	22.85	22.62	22.39	22.16	21.93	21.70	21.47	21.25	21.02	20.79	20.56
Dec-08	22.40	21.65	21.50	21.35	21.20	21.06	20.91	20.76	20.61	20.46	20.31	20.16
Jan-09	19.89	20.60	20.74	20.88	21.02	21.16	21.30	21.44	21.59	21.73	21.87	22.01
Feb-09	20.66	21.18	21.28	21.38	21.49	21.59	21.69	21.79	21.90	22.00	22.10	22.20
Mar-09	20.54	21.08	21.19	21.30	21.41	21.52	21.63	21.74	21.85	21.95	22.06	22.17
Apr-09	20.11	20.76	20.89	21.02	21.15	21.28	21.41	21.54	21.67	21.80	21.93	22.07
May-09	19.66	20.42	20.57	20.73	20.88	21.03	21.19	21.34	21.49	21.65	21.80	21.95
Jun-09	19.55	20.35	20.50	20.66	20.82	20.98	21.14	21.29	21.45	21.61	21.77	21.93

Supplement Table 1 and Supplement Figure 1 illustrate the extent to which the impact of the share of purchased feed has on total feed cost. In the Supplement Table 1, before January 2009, higher purchased feed share is associated with higher new feed cost, but this positive association has reversed from that point onward. The reversal was a result of the purchased feed cost in the new month was turning from rising to falling, compared to the average of the previous year. Drawing from **equation FC_t** in **(1)**, when the purchased feed cost was rising and the term $\mathbf{HFCI_t}$ rose higher than the term $\mathbf{HFCI_{base\text{-}average}}$, it resulted in the term $(\mathbf{HFCI_t/HFCI_{base\text{-}average}} - 1)$ to be greater than zero. This has an upward impact on the total feed cost. Thus, when the purchased feed cost was rising, compared to the previous year average, the "new" total feed cost increased more the larger the share of purchased feed from outside sources. However, from January 2009, the term $(\mathbf{HFCI_t/HFCI_{base\text{-}average}} - 1)$ turned negative, because the purchased feed cost from outside sources was falling at a magnitude sufficient to have caused the term $\mathbf{HFCI_t}$ to drop lower than the term $\mathbf{HFCI_{base\text{-}average}}$. This has caused a downward impact on the "new" feed cost. Thus, an operation with a higher purchased feed share has incurred a lower "new" feed cost (or has feed cost falling faster) than an operation with a lower share of purchased feed. The greater the percent share of feed purchased from outside sources, the greater the impact of feed price and shipping cost fluctuations will be on the total cost of feed in either direction, up or down. That is, when the combined feed prices and shipping cost increases, feed cost will rise higher the greater the share of purchased feed from outside sources is. On the other hand, when the combined feed prices and shipping cost decreases, feed cost will fall further the greater the share of purchased feed from outside sources is. This is made explicit in **equation FC_t** in **(1)**.

Supplement Figure 1.



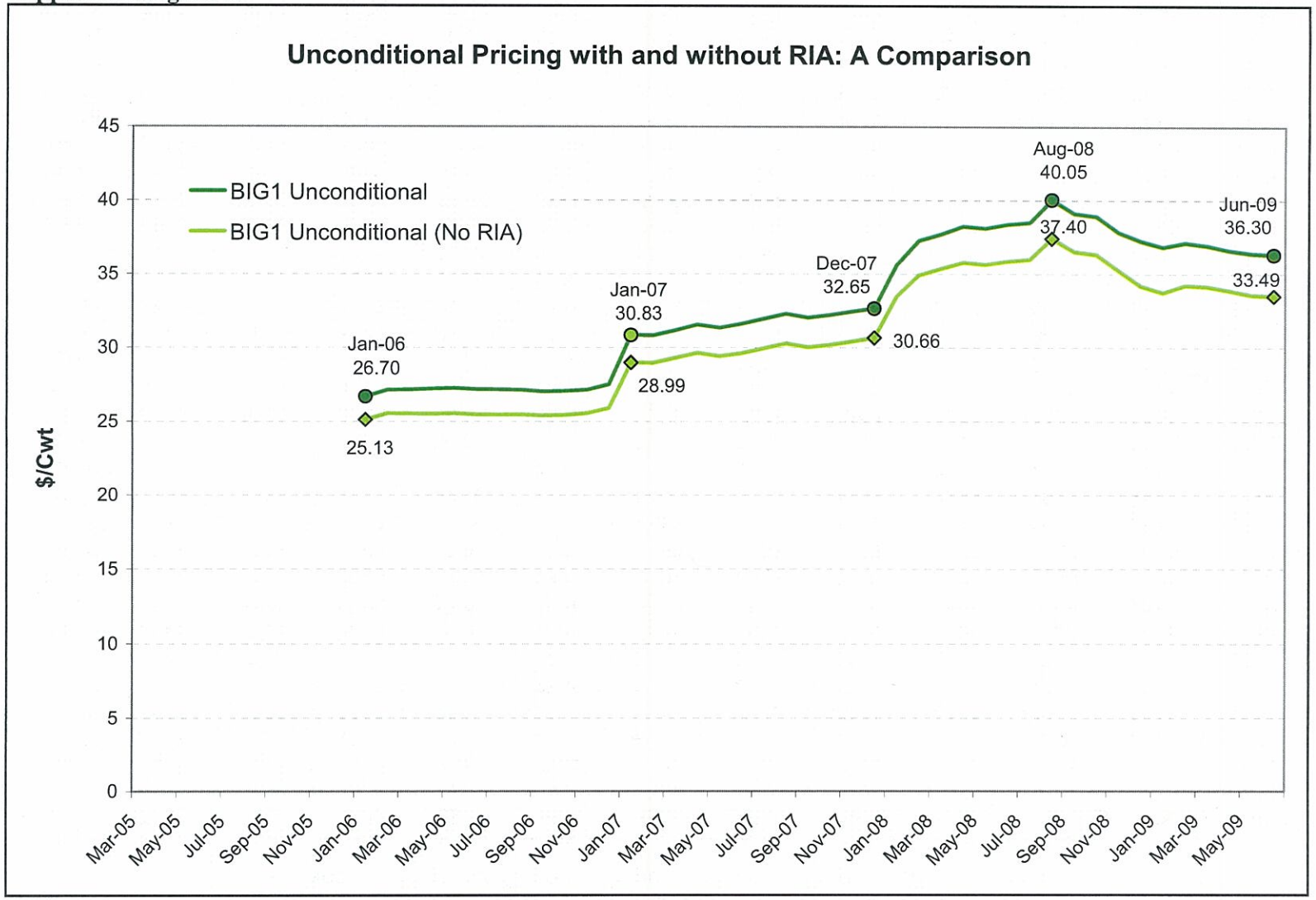
Supplement Table 2. A Summary of Pricing Results with Various Conditions and Selected Indicators

	Unconditional (RIA Excluded)	Unconditional (with RIA included)	Conditional to NCA Basis	Conditional to NCA with Stabilizer = 1	Conditional to NCA with Stabilizer = 3	Conditional to NCA with Stabilizer = 5	BIG Class I Min Price (existing system)	NCA Basis	NCA Class I	Breakeven Basis (real time)[1]
Mar-05							26.53	28.28	16.08	25.03
Apr-05							26.53	27.94	15.74	25.03
May-05							26.53	28.58	16.38	25.03
Jun-05							26.53	26.95	14.75	25.03
Jul-05							26.53	27.39	15.19	25.03
Aug-05							26.53	28.04	15.84	25.03
Sep-05							26.53	27.42	15.22	25.03
Oct-05							26.53	27.76	15.56	25.03
Nov-05							26.53	27.72	15.52	25.03
Dec-05							26.53	27.19	14.99	25.03
Jan-06	25.13	26.70	26.70	26.03	26.70	26.70	26.53	26.69	14.49	28.32
Feb-06	25.56	27.16	27.16	26.03	27.16	27.16	26.53	26.67	14.47	28.32
Mar-06	25.54	27.18	26.31	26.03	26.31	26.31	26.53	25.39	13.19	28.32
Apr-06	25.53	27.23	25.71	25.71	25.71	25.71	26.53	24.73	12.53	28.32
May-06	25.57	27.29	24.63	25.03	25.03	25.03	26.53	24.53	12.33	28.32
Jun-06	25.49	27.21	25.51	25.51	25.51	25.51	26.53	24.55	12.35	28.32
Jul-06	25.47	27.19	25.51	25.51	25.51	25.51	26.53	24.57	12.37	28.32
Aug-06	25.48	27.16	25.13	25.13	25.13	25.13	26.53	24.23	12.03	28.32
Sep-06	25.42	27.06	25.62	25.62	25.62	25.62	26.53	24.82	12.62	28.32
Oct-06	25.45	27.09	26.60	26.03	26.60	26.60	26.53	25.77	13.57	28.32
Nov-06	25.57	27.16	26.18	26.03	26.18	26.18	26.53	25.28	13.08	28.32
Dec-06	25.91	27.53	26.81	26.03	26.81	26.81	26.53	25.54	13.34	28.32
Jan-07	28.99	30.83	30.83	29.32	30.83	30.83	26.53	25.93	13.73	32.24
Feb-07	28.99	30.81	30.81	29.32	30.81	30.81	26.53	27.30	15.10	32.24
Mar-07	29.30	31.14	31.14	29.32	31.14	31.14	26.53	27.94	15.74	32.24
Apr-07	29.65	31.54	31.54	29.32	31.32	31.54	26.53	28.64	16.44	32.24
May-07	29.44	31.32	31.32	29.32	31.32	31.32	26.53	29.64	17.44	32.24
Jun-07	29.62	31.61	31.61	29.32	31.32	31.61	26.53	32.21	20.01	32.24
Jul-07	29.95	31.95	31.95	29.32	31.32	31.95	29.53	35.19	22.99	32.24

	Unconditional (RIA Excluded)	Unconditional (with RIA included)	Conditional to NCA Basis	Conditional to NCA with Stabilizer = 1	Conditional to NCA with Stabilizer = 3	Conditional to NCA with Stabilizer = 5	BIG Class I Min Price (existing system)	NCA Basis	NCA Class I	Breakeven Basis (real time)[1]
Aug-07	30.27	32.29	32.29	29.32	31.32	32.29	29.53	35.69	23.49	32.24
Sep-07	30.03	32.01	32.01	29.32	31.32	32.01	29.53	35.03	22.83	32.24
Oct-07	30.19	32.20	32.20	29.32	31.32	32.20	29.53	35.74	23.54	32.24
Nov-07	30.42	32.43	32.43	29.32	31.32	32.43	29.53	35.36	23.16	32.24
Dec-07	30.66	32.65	32.65	29.32	31.32	32.65	29.53	35.19	22.99	32.24
Jan-08	33.45	35.59	35.59	33.24	35.24	35.59	29.53	37.82	22.96	35.55
Feb-08	34.91	37.23	37.23	33.24	35.24	37.23	29.53	36.57	21.71	35.55
Mar-08	35.35	37.67	35.60	33.24	35.24	35.60	29.53	33.76	18.90	35.55
Apr-08	35.77	38.21	37.17	33.24	35.24	37.17	29.53	34.78	19.92	35.55
May-08	35.63	38.08	35.90	33.24	35.24	35.90	29.53	33.64	18.78	35.55
Jun-08	35.86	38.36	37.62	33.24	35.24	37.24	29.53	35.09	20.23	35.55
Jul-08	35.98	38.47	38.47	33.24	35.24	37.24	29.53	37.35	22.49	35.55
Aug-08	37.40	40.05	38.87	33.24	35.24	37.24	29.53	34.65	19.79	35.55
Sep-08	36.50	39.11	37.38	33.24	35.24	37.24	29.53	34.09	19.23	35.55
Oct-08	36.32	38.92	36.18	33.24	35.24	36.18	29.53	33.09	18.23	35.55
Nov-08	35.22	37.80	35.55	33.24	35.24	35.55	35.53	33.58	18.72	35.55
Dec-08	34.18	37.22	32.82	32.82	32.82	32.82	35.53	31.43	16.57	35.55
Jan-09	33.71	36.81	36.81	36.55	36.81	36.81	35.53	32.28	17.42	35.55
Feb-09	34.21	37.10	31.80	35.55	35.55	35.55	35.53	26.13	11.27	35.55
Mar-09	34.13	36.91	31.47	35.55	35.55	35.55	35.53	25.99	11.13	35.55
Apr-09	33.85	36.59	31.60	35.55	35.55	35.55	35.53	26.44	11.58	35.55
May-09	33.56	36.38	32.49	35.55	35.55	35.55	35.53	27.54	12.68	35.55
Jun-09	33.49	36.30	31.43	35.55	35.55	35.55	35.53	26.56	11.70	35.55

[1] "Breakeven Basis (real time)" refers to the direct cost of milk production reported (except for 2008) for the corresponding years as listed in the table. For 2008, the breakeven basis is an estimate, as cost of production report is unavailable. It is noteworthy to point this out, as the new price generated by the model is derived based on a breakeven basis of the previous year. For instance, the new price for any month in 2008 is derived based on a "Breakeven Basis (real time)" for 2007.

Supplement Figure 2.



Supplement Table 3.

Impact of Purchased Feed Share on New Unconditional Breakeven Price
At Various Percentage Shares of Import Feed Purchased in Total Feed Used

	100%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%
						$/Cwt						
Jan-06	26.75	26.71	26.70	26.70	26.69	26.68	26.67	26.66	26.66	26.65	26.64	26.63
Feb-06	27.47	27.25	27.21	27.16	27.12	27.08	27.03	26.99	26.95	26.90	26.86	26.82
Mar-06	27.47	27.26	27.22	27.18	27.14	27.10	27.05	27.01	26.97	26.93	26.89	26.84
Apr-06	27.52	27.32	27.28	27.23	27.19	27.15	27.11	27.07	27.03	26.99	26.95	26.91
May-06	27.60	27.38	27.33	27.29	27.25	27.20	27.16	27.11	27.07	27.03	26.98	26.94
Jun-06	27.47	27.29	27.25	27.21	27.18	27.14	27.10	27.06	27.03	26.99	26.95	26.91
Jul-06	27.45	27.27	27.23	27.19	27.16	27.12	27.09	27.05	27.01	26.98	26.94	26.90
Aug-06	27.42	27.23	27.20	27.16	27.12	27.09	27.05	27.01	26.98	26.94	26.90	26.86
Sep-06	27.28	27.12	27.09	27.06	27.03	26.99	26.96	26.93	26.90	26.86	26.83	26.80
Oct-06	27.33	27.16	27.12	27.09	27.05	27.02	26.98	26.95	26.91	26.88	26.85	26.81
Nov-06	27.47	27.25	27.20	27.16	27.11	27.07	27.03	26.98	26.94	26.89	26.85	26.80
Dec-06	28.03	27.67	27.60	27.53	27.45	27.38	27.31	27.24	27.17	27.09	27.02	26.95
Jan-07	31.22	30.94	30.89	30.83	30.78	30.72	30.67	30.61	30.56	30.50	30.45	30.39
Feb-07	31.19	30.92	30.86	30.81	30.75	30.70	30.64	30.59	30.53	30.48	30.43	30.37
Mar-07	31.70	31.30	31.22	31.14	31.06	30.98	30.90	30.82	30.74	30.66	30.58	30.50
Apr-07	32.30	31.76	31.65	31.54	31.43	31.32	31.21	31.11	31.00	30.89	30.78	30.67
May-07	31.96	31.50	31.41	31.32	31.23	31.14	31.04	30.95	30.86	30.77	30.68	30.59
Jun-07	32.36	31.82	31.72	31.61	31.50	31.39	31.29	31.18	31.07	30.97	30.86	30.75
Jul-07	32.88	32.21	32.08	31.95	31.81	31.68	31.54	31.41	31.28	31.14	31.01	30.87
Aug-07	33.41	32.61	32.45	32.29	32.13	31.97	31.81	31.65	31.49	31.32	31.16	31.00
Sep-07	33.00	32.29	32.15	32.01	31.87	31.73	31.59	31.45	31.31	31.17	31.03	30.89
Oct-07	33.27	32.50	32.35	32.20	32.04	31.89	31.74	31.58	31.43	31.28	31.12	30.97
Nov-07	33.64	32.77	32.60	32.43	32.26	32.08	31.91	31.74	31.57	31.39	31.22	31.05
Dec-07	33.99	33.03	32.84	32.65	32.45	32.26	32.07	31.88	31.69	31.50	31.30	31.11
Jan-08	36.28	35.79	35.69	35.59	35.49	35.39	35.29	35.19	35.10	35.00	34.90	34.80
Feb-08	38.76	37.67	37.45	37.23	37.01	36.79	36.57	36.35	36.13	35.92	35.70	35.48
Mar-08	39.45	38.18	37.92	37.67	37.41	37.16	36.90	36.65	36.39	36.14	35.88	35.62
Apr-08	40.24	38.79	38.50	38.21	37.92	37.63	37.34	37.05	36.76	36.47	36.18	35.89
May-08	40.03	38.64	38.36	38.08	37.80	37.53	37.25	36.97	36.69	36.41	36.13	35.85

Impact of Purchased Feed Share on New Unconditional Breakeven Price

At Various Percentage Shares of Import Feed Purchased in Total Feed Used

	100%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%
Jun-08	40.44	38.95	38.66	38.36	38.06	37.76	37.46	37.17	36.87	36.57	36.27	35.98
Jul-08	40.63	39.09	38.78	38.47	38.16	37.86	37.55	37.24	36.93	36.63	36.32	36.01
Aug-08	43.02	40.90	40.47	40.05	39.62	39.20	38.77	38.35	37.92	37.50	37.07	36.65
Sep-08	41.57	39.81	39.46	39.11	38.76	38.41	38.06	37.71	37.36	37.01	36.65	36.30
Oct-08	41.27	39.59	39.25	38.92	38.58	38.24	37.91	37.57	37.24	36.90	36.56	36.23
Nov-08	39.52	38.29	38.04	37.80	37.55	37.30	37.06	36.81	36.57	36.32	36.07	35.83
Dec-08	38.36	37.55	37.38	37.22	37.06	36.89	36.73	36.57	36.41	36.24	36.08	35.92
Jan-09	35.73	36.50	36.66	36.81	36.97	37.12	37.28	37.43	37.59	37.74	37.89	38.05
Feb-09	36.32	36.87	36.99	37.10	37.21	37.32	37.43	37.54	37.65	37.77	37.88	37.99
Mar-09	36.08	36.67	36.79	36.91	37.03	37.14	37.26	37.38	37.50	37.62	37.73	37.85
Apr-09	35.60	36.30	36.44	36.59	36.73	36.87	37.01	37.15	37.29	37.43	37.57	37.71
May-09	35.22	36.05	36.22	36.38	36.55	36.72	36.88	37.05	37.21	37.38	37.55	37.71
Jun-09	35.10	35.96	36.13	36.30	36.47	36.64	36.82	36.99	37.16	37.33	37.50	37.67